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METEOROLOGICAL

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Edited by HUGH ROBERT MILL, D.Sc., LL.D.

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AIDS TO RAINFALL OBSERVERS.

THE exhaustion of the edition of "Rules for Rainfall Observers" has afforded an opportunity for revising the little pamphlet originally edited by Mr. Symons, and throwing the gradual growth of experience into a more systematic form. The rules have been added to as occasion required, but, like all gradual growths, the time arrived when a revision almost equivalent to re-writing was required to restore the symmetry of the first edition while retaining the improvements of the last. The time is rapidly approaching when the records of imperfectly constructed or ill-exposed gauges can be dispensed with as useless, and the time has come when no new gauge should be recognised as satisfactory unless both funnel and measuring-glass have been scientifically tested and certified as accurate. No high-class instrument maker objects to submit his work to such tests, and the few extra shillings required for a certificate purchase for the observer a sense of confidence in his instruments which is a continual satisfaction. The new edition of the Rules drops some of the cautions as to the use of gauges made of improper materials, such as japanned or tinned iron, and directs attention to the importance of using recording gauges whenever it is possible to do so.

In response to many requests, Dr. H. R. Mill has designed a Pocket Rain Register for the use of observers. It takes the form of a little book with rounded corners, daintily bound in linen, and measuring only $5\frac{3}{4}$ inches by $2\frac{1}{2}$ inches. The double page at each opening gives space for recording the daily rainfall for a month for from one to four gauges, and room is provided also for remarks on each day. The book is planned to last for a year and in addition to the blank pages contains instructions for using the forms provided for comparing the actual rainfall of each month with the average, as well as a condensed series of rules for making rainfall observations. There are also tables of average monthly rainfall at seven British or Irish stations representing places with mean annual rainfalls of 20, 25, 30, 35, 40, between 50 and 60, and over 100 inches respectively. A short table of useful memoranda is added, including such points as the definition of "Rain" and of droughts, and the number of tons of water corresponding to an inch of rain on an acre, about which questions are continually being asked. Like all the publications of the Rainfall Organization, this book is sold to the public only through the publisher, Mr. Stanford, although observers may, if they prefer it, obtain copies (by post only) from the Editor.

In concluding the volume of this Magazine for 1903 we have to thank our readers for much consideration and help and to ask for more, so that it may be possible without serious loss to maintain the increase of 25 per cent. in the size of the Magazine throughout the coming year. The expense of advertising a journal appealing to so small a section of the public is prohibitory, but the Editor is always glad to send a specimen copy to any one whose name is sent to him as likely to be interested, and he asks his readers to mention this to their friends.

January, 1904.

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Frontispiece.] THE SOUTHPORT METEOROLOGICAL BREAKFAST. [*Photograph by J. A. Kay, Southport.*

SYMONS'S

METEOROLOGICAL MAGAZINE.

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THE CANADIAN CLIMATE.

By R. F. STUPART, Director Meteorological Service, Dominion of Canada.

CANADIANS reading newspapers and journals published in Great Britain, cannot fail to be struck with the profound misconception which appears to be fairly general regarding the climate and geographical position of Canada. Perhaps Canadians may be to a certain extent guilty of having unwittingly assisted in spreading the erroneous notions regarding their country, by, annually at Christmas time, disseminating photographs of winter scenery to friends in the old land. It is the Christmas pictorial newspapers with their Santa Claus and reindeer, snowbanks and ice-palaces, fur-coats and snow-shoes, which find their way most frequently to England. It is at Christmas that persons wish to send home some small remembrance; what more interesting than a winter scene with people walking about dressed in furs with snow-shoes slung over the shoulder, or pictures of people sliding down ice covered hills in the wildly exhilarating sport of tobogganing? This going on year after year has constantly had a tendency to make Britishers associate Canada with the Polar Regions. As there is certainly fallacy in the conception of Canada as an exceedingly cold country, the writer will endeavour briefly to present certain facts regarding the Canadian climate in the hope that at least some erroneous impressions may be removed.

Canada is the northern half of a continent which stretches from the subtropics to the Arctic Sea, and the older provinces of the Dominion, viz., Ontario, Quebec and the Maritime Provinces lie wholly further south than does any portion of Great Britain. Toronto is 550 miles further south than London, Montreal 418 miles further south, and Halifax 478 miles further south. It may surprise many that a large portion of Ontario lies as far south as the South of France and northern Spain and Italy; Toronto is further south than Florence, and the southern point of Ontario is further south than Rome. In addition to this, portions of the North West Territories, a strip of territory 70 miles in width including parts of Manitoba, Assiniboia and Alberta are also further south than any portion of England. No portion of Canada's present wheat fields in Manitoba and the North West Territories lies as far north as Scot-

be floated to the great water courses and the mills. The Ontario lumberman, the farmer, and the business man all pray for a winter with lots of snow and steady cold; these are conditions which mean prosperity, and when the snows begin to melt in March all may look forward with confidence to a short spring followed by a long delightful summer, which fades gradually into autumn with its golden tints which last to the middle of October, and not infrequently into November. The climate of southern Ontario is very appreciably warmer than that of the more northern parts of the province; were the month of March a little warmer it would be well nigh a perfect climate. Signs of spring begin to multiply early in April or indeed in March, and between the middle of May and the middle of September the whole district is included between the same isotherms as the greater portion of France, and it is only after a protracted autumn that winter sets in about the beginning of December. The winters are by no means severe, and the summers seldom oppressively hot; this being due to the tempering influence of the Great Lakes by which this portion of Ontario is surrounded. In the more southern and western counties of the province the April mean temperature corresponds nearly to that of the south of Scotland, and in May the mean temperature of the whole district is slightly higher than for the south of England. The summer months proper are distinctly warmer than in England, but in few districts does the mean temperature exceed 70°, hence the heat is by no means excessive. A gentleman who has now spent two winters in Canada, about a month ago on leaving for Scotland remarked to the writer, "I wish I were to remain in Canada this summer; I quite realize that Toronto between May and September enjoys a climate that cannot be excelled." The annual precipitation of the whole of Ontario lies between 30 and 40 inches, which is fairly evenly distributed throughout the year; in summer, however, the rain generally falls in thunderstorms, and cloudy wet days are of very rare occurrence.

(To be continued.)

THE TEMPERATURE OF AIR AND RIVERS.

The Rev. W. Andson, of Ivy Bank, Dumfries, recently read to the local Natural History and Antiquarian Society a paper discussing a series of observations on the temperature of the water of the river Nith and its estuary with reference to the temperature of the air. The observations had been carried on for a year from June 1st, 1901, to May 31st, 1902, and were undertaken at the request of Mr. Calderwood, the Inspector of Salmon Fishing under the Fishery Board for Scotland. At Mr. Calderwood's suggestion a maximum and a minimum thermometer were used, placed in a perforated copper vessel and hung in the current in such a way as to be continuously immersed. The thermometers were read daily, those in

the river at Dumfries being under the charge of Mr. Andson, those in the estuary at Glencaple under the charge of the Rev. James Malcolm. In the course of his paper Mr. Andson gave the following table, which we reprint with a summary of his explanatory remarks :—

Months.	River Water. Mean Temp.		Estuary. Mean Temp.		Air. Mean Temp.	
	°		°		°	
December	37·1		37·6		37·0	
January	38·1	36·5	40·0	37·5	39·2	36·7
February	34·5		34·9		34·0	
March	42·8		43·0		43·8	
April	45·2	46·0	44·0	45·6	46·0	45·7
May	50 0		50·0		47·3	
June	57·2		58·2		56·0	
July	66·1	61·0	65·6	61·9	64·6	59·9
August	59·9		62·1		59·2	
September	55·4		57·2		55·8	
October	48·5	48·2	49·9	50·1	48·3	48·4
November	40·8		43·1		41·3	

The range of the river temperatures is much more limited than that of the air or land. The highest temperature recorded for the river was 74°, on July 20th, and the lowest was 31°·5, say 32° to avoid fractions, on February 10th, giving a range of 42° for the year. In the air or land observations, on the other hand, the highest temperature was 90° on the same day in July, and the lowest 6°, on a day in February, which would give an annual range of 84°. As the above values, however, were abnormal, it is better to substitute for them a fifteen years' average of the highest single day temperatures, and a similar average of the lowest, which would alter the range to 84° for the highest and 14° for the lowest, and show an annual range of 70° for the air, as compared with 42° for the river. The mean maximum for the year being 49°·9, and the mean minimum 46°·3, the mean daily range would only be 3°·6. For the air the mean maximum was 54°·4, the mean minimum 40°·5, hence the mean daily range would be 14°·4. But now, when we compare the mean annual temperatures of air and water, we find a remarkable agreement. They almost exactly coincide. The one (air) is 47°·7 ; the other (water) is 47°·8. The use of self-registering minimum as well as maximum thermometers to record the temperature is fitted to secure greater accuracy ; and when the yearly mean, founded on such observations, is found to correspond with that of the air for the same period, it is only what might be expected, and may be regarded, indeed, as an evidence of the accuracy of the observations. This coincidence of annual means does not, however, necessarily imply a like coincidence in the monthly means. It will be seen from the table that the months in which they approximate most closely are the autumn and winter months, and those in which

they diverge most are in spring partly, but still more in summer. In August, September, October, November, December, February, and April there is only a difference of a fraction of a degree; but in January, March, May, June, and July from 1° in March to 2°·7 in May. If now we compare the temperature of the river with that of the estuary at Glencaple, we find a different result. The annual means, instead of coinciding, show an excess of almost 1° in favour of the estuary, viz., 48°·7. The annual mean of the river as ascertained by the observations ten years ago, was 48°·5, as compared with 47°·8. The explanation of this is very simple. The observations of the estuary having been taken always at or near high tide, and during the day, would, as a rule, be near the maximum, while those, both of the river and the air, were calculated from the combined maxima and minima of each day; and then the flow of the tide over a large extent of sand in warm, sunny weather must also necessarily have the effect of increasing the estuary temperature.

FOUR MONTHS WINTER RAINFALL, OCTOBER, 1902—JANUARY, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Station.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	—1·53	82	Arncliffe	+ ·29	101	Braemar	+2·76	121
Tenterden	—1·21	88	Hull	— ·76	92	Aberdeen	+ ·25	102
Hartley Wintney	— ·92	90	Newcastle	— ·06	99	Cawdor	+ ·51	105
Hitchin	—1·57	82	Seathwaite	—4·07	93	Glencarron	+ ·15	100
Winslow	—2·01	77	Cardiff	+2·01	113	Dunrobin	—2·33	82
Westley	—2·74	69	Haverfordwest	+1·87	110	Darrynane	—1·81	91
Brundall	—2·77	69	Gogerddan	— ·86	96	Waterford	+3·79	126
Alderbury	—1·06	91	Llandudno	—1·07	92	Broadford	+1·32	110
Ashburton	+ ·02	100	Dumfries	+1·64	109	Carlow	+2·19	117
Polapit Tamar	+2·84	118	Lilliesleaf	+2·49	122	Dublin	+1·15	111
Stroud	+ ·03	100	Colmonell	+2·19	112	Mullingar	+2·19	117
Woolstaston	— ·65	94	Glasgow	+2·07	114	Ballinasloe	+ ·33	102
Boston	— ·91	87	Inveraray	—1·68	95	Clifden	—1·89	94
Hesley Hall	— ·34	96	Islay	—1·58	92	Crossmolina	+ ·21	101
Derby	— ·13	98	Mull	— ·82	97	Seaforde	+3·27	123
Bolton	— ·27	98	Loch Leven	+1·72	112	Londonderry	—1·26	92
Wetherby	+1·41	117	Dundee	+ ·24	102	Omagh	+1·55	110

It is generally recognised that for water storage, and especially for replenishing the underground supplies in wells and springs, the effective part of the year's rain is that which falls in the winter months, when evaporation and vegetation are at their minimum. We have accordingly compared the rainfall of the four months, October, 1902, to January, 1903, with the average of the corresponding months for the ten years, 1890-99, adjusted to the monthly incidence of rainfall of thirty years. The result is to show that over

by far the greater part of the British Isles the small rainfall of 1902 will not produce any immediate bad effects, because the heavy rainfall of December and January, though but a small part of the annual supply, has come at the most useful time. The figures published above show that over Cornwall, Devon, Somerset, Gloucester, Hereford and South Wales, the winter's rain is so far well in advance of the average. This is true also for the north-east of England, and for the whole of Ireland and Scotland, except their west and north coasts. The only parts of the country which have had as much as 10 per cent. less than the average fall for the four months appear to be the extreme north of Scotland and the south-east of England. The winter has been relatively driest in East Anglia, where the only stations here considered, one in Norfolk and one in Suffolk, report less than 70 per cent. of the normal fall, a very unsatisfactory state of matters.

For the first time for many months the differences from the average in our Rainfall Table are practically all excesses. January has proved a wet month over the whole of the British Isles, though in few places excessively so. As we write news comes in of very heavy rains in the early part of February over the north of England, and especially the south of Scotland, where extensive floods were caused.

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday, January 21st, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. W. H. Dines, B.A., President, in the Chair.

Mr. F. C. Bayard read the Report of the Council for the past year, which showed that the Society had made steady progress, there being an increase of 20 in the number of Fellows. The Society's Howard Silver Medal, annually awarded to the cadets of H.M.S. *Worcester*, had been gained by Cadet R. T. Snape. The exhaustive Meteorological Bibliography, commenced many years ago by the late Mr. G. J. Symons, was being continued by the Society. As the Bibliography cannot be supposed to be complete, the Council invited the Fellows and others to send to the Society for record, a copy of all meteorological books and papers of which they may be the authors. The Council had also undertaken to furnish for the *International Catalogue of Scientific Literature* the titles of all works bearing on meteorology which are published in the British Isles.

The report having been adopted, votes of thanks were passed to the Council for their services during the past year, and also to the President and Council of the Institution of Civil Engineers for allowing the meetings to be held in the rooms of the Institution.

The President, in his address, dealt with "The method of kite-flying from a steam vessel, and meteorological observations obtained thereby off the West Coast of Scotland." In the spring of 1901 the Royal Meteorological Society appointed a Committee for the purpose

of making an investigation as to the temperature and moisture of the upper air, and the British Association, at the meeting in Glasgow, also appointed a committee to co-operate in the work. At the request of this joint committee Mr. Dines undertook to carry on the enquiry during the summer of 1902, and in this address he gave a full account of what he had done. After describing the apparatus (particulars of which will be found in *Symons's Met. Mag.* for May and October, 1902), he gave an account of the observations at a fixed station and also from a steam tug in the neighbourhood of Crinan, Argyllshire. He had acquired a considerable amount of information concerning meteorological phenomena, having obtained 71 observations of temperature at an average height of 4140 feet, and 38 charts from the self-recording instruments with an average of over 6000 feet. The greatest height attained was 15,000 feet with four kites on the wire. The temperature gradient over the sea was considerably less than its average value over the land, being about 1° for every 350 feet of height. The upper currents were found to differ in direction from those below much less than was expected. As a general rule the humidity increased up to about a mile and then decreased.

A hearty vote of thanks was accorded to Mr. Dines for carrying out the kite observations and also for his services as President during the past year.

The following gentlemen were elected the officers and council for the ensuing year:—

President, Capt. D. Wilson-Barker. *Vice-Presidents*, Mr. W. H. Dines; Capt. M. W. C. Hepworth, C.B.; Mr. E. Mawley and Dr. W. N. Shaw, F.R.S. *Treasurer*, Dr. C. Theodore Williams. *Secretaries*, Mr. F. C. Bayard and Dr. H. R. Mill. *Foreign Secretary*, Dr. R. H. Scott, F.R.S. *Council*, Mr. R. Bentley; Mr. J. Y. Buchanan, F.R.S.; Capt. W. F. Caborne, C.B.; Capt. A. Carpenter, R.N., D.S.O.; Mr. R. H. Curtis; Mr. F. Druce; Mr. W. Ellis, F.R.S.; Mr. C. Hawksley; Mr. J. Hopkinson; Mr. R. Inwards; Mr. B. Latham and Mr. H. Mellish.

The meeting was preceded by a brief ordinary meeting, at which the following were elected Fellows of the Society:—Mr. W. R. Bell; Mr. A. M. Edwards; Mr. J. McConnell; Mr. W. E. Markham; Mr. W. F. Preedy; Dr. W. Prowse; Major V. S. Sandeman and Mr. T. Thornton.

Correspondence.

ON SOME PRECURSORS OF WEATHER CHANGE.

To the Editor of Symons's Meteorological Magazine.

1. *Fine weather preceded by calm at night.*—The fine weather which followed the thundery time August 4th–14th, 1895, was ushered in by a close and marvellously still night. The calm which prevailed was phenomenal, a stillness that might be felt. The whole animal world seemed to share in it. Not a leaf stirred nor a bird broke the

silence. Even the moths seemed to have ceased their nightly wanderings. The same stillness, followed by similar weather, was noted in July, 1900, and recently, 1902, has preceded the lovely harvest weather of September, after a wet Summer.

2. *Fine weather indicated by filmy Strato-cirrus.*—When the deep orange glow and fine crimson-tinted bands of cirrus and cirro-stratus ornament the upper sky, very fine, filmy thread-like lines come into view, being illumined by the rays of the descending sun. This appearance occurred before the glorious harvest weather at the end of August and beginning of September, 1895, before the drought of 1899, and was seen through the drought of 1901.

These lines are quite straight, and are sometimes flecked or barred by cross lines, giving a slightly matted appearance. Their visibility evidently depends on their position with regard to the sun, and they belong probably to the hazy thin sheets of cirrus and cirro-stratus in the upper sky, foreshortened by distance. This cloud showed itself on the evening of July 5th, 1900, about sunset, in very straight form. This was followed by a dry week of great heat, 137° in the sun, 93° in the shade, in London. The same form of cloud preceded the dry summer of 1899, appearing through the mists of early dawn in a rigidly straight line, dipping from S. to W.; 12° N. to E. at sunrise and S. to W. at sunset. It was also common during the drought of 1901.

On August 24th, 1902, a highly prismatic halo presenting in its upper arc two lines of refraction, was visible in the hazy blue-grey upper drift. This halo was right above the loose cirro-cumulus. Believing that it meant a change of atmospheric conditions, I took the following notes. Three fine days followed, not the imaginary storm popularly associated with halos. These optical appearances have been uncommon during the past rainy summer. On August 24th, 25th, the curious dead calm, above alluded to, was most noticeable, and the weather improved from that date. It seems that rooks, by their immensely elevated spiral soaring and their joyous cries and "churring," possess premonitory sensations indicating change to fine weather. At any rate they have shown these lively movements on almost every occasion of recent weather improvement.

SAMUEL BARBER.

Elmsett, Ipswich.

REVIEWS.

Natural Law in Terrestrial Phenomena. A study in the causation of earthquakes, volcanic eruptions, wind-storms, temperature, rainfall, with a record of evidence by WILLIAM DIGBY, C.I.E. London: W. Hutchinson & Co. 1902. Size 9 × 5½. Pp. xlvi. + 370.

THAT the weather of our planet is controlled by the moon is a venerable belief as old as the hills, and it would appear to be almost as easy to remove the hills themselves as to get some people, not

lacking in ordinary intelligence, to realize the fact that modern enquiry has failed to show the existence of any real foundation for its acceptance.

The most recent adventurer in the direction of formulating a theory of the moon's influence on the weather is Mr. Hugh Clements, whose name is probably already familiar to many of our readers as that of a lunarist whose "long distance" predictions of weather have not infrequently appeared in the public press.

A fundamental principle of Mr. Clements' theory is one which is common to nearly all believers in the moon's influence upon our weather—namely, that similar conditions of weather must always recur with the recurrence of the same relative positions of the Earth and moon; and it is upon this axiom that he rests a claim to be able to predict with accuracy the weather "for any number of days, weeks, months, or years ahead, upon a scientific system from which the element of chance is eliminated."

This axiom is elaborated at some length in the volume under review, in which the explanation of Mr. Clements' theory is accompanied by numerous statements intended to support and justify it. The book is not, however, from the pen of Mr. Clements, and this is somewhat curious, because he has already shown himself quite able to expound his own views, whilst Mr. Digby appears to be under the disadvantage of having first approached the study of the subject only a few months before the book was published. We are not told why so important a task was delegated to so recent a disciple; nor can we find that Mr. Digby has made any independent tests of the statements by which his judgment seems to have been convinced.

Put briefly, Mr. Clements finds a full explanation of all terrestrial weather phenomena, and also of seismic and volcanic phenomena, in the "tangential pull of the moon," slightly modified by the position of the sun; and he holds that "when once more the moon appears in the position she occupies to-day, with the sun in like position, the same phenomena as that which is passing under our eyes will be reproduced." This exact recurrence takes place, we are told, every 186 years, and on p. 281 we read that therefore "the years 1692 and 1693 were the exact meteorological counterpart of 1878 and 1879." This is a definite statement, made without qualification; but when a little further on we find the casual admission that no detailed information exists as to the weather of those early years, from which alone it would be possible to decide whether or not they corresponded meteorologically with the later ones named, we think ourselves justified in hesitating to accept without reserve the statement that they did do so.

Many references are made to Mr. Clements' predictions, and to the remarkable way in which they are said to have been fulfilled. Most of these statements cannot easily be verified, owing to the way in which they are given, as *e.g.*, "My predictions for the 17th, 18th, 19th and 20th agreed with Greenwich"; whilst elsewhere they are

exhibited by means of diagrams so drawn that they cannot readily be followed. But on pp. 330–331 there is given in parallel columns what purports to be the Meteorological Office prediction for each day of February, 1895, the weather actually experienced at Greenwich, and Mr. Clements' prediction for the same period. It is to be remembered that the Meteorological Office forecast embracing Greenwich covers the district of "South England," and comprises wind as well as weather; the part relating to wind has, however, been omitted by Mr. Digby.

From a general comparison of the three columns it is perfectly clear that the Meteorological Office forecasts better indicated the weather actually recorded than did those of Mr. Clements. But if we deal with them more specifically, and select for examination one element, viz., precipitation, we find that the Office indicated rain or snow for 21 days, on 13 of which one or the other occurred at Greenwich, whilst on the remainder the weather is described as having been "overcast" or "unsettled"—conditions certainly suggestive of rain. On one day rain fell although the Office had not predicted it. Mr. Clements, on the other hand, predicted rain or snow for 10 days, on only 5 of which did rain or snow occur, whilst on 8 others on which there was rain his prediction did not refer to it. Yet this is a selected forecast put forward in support of the statement that whilst "weather prediction (by the Meteorological Office) has become a by-word and a scorn, a thing for contemptuous comment" (p. 43), and its mistakes have been so grotesque and numerous that "No citizen considers himself so low in the scale of criticism that he feels it would be unseemly for him to jeer at the weather-prophet of Victoria Street" (p. 261), yet Mr. Clements is able by his system to forecast the weather for years ahead with absolute accuracy, "from which the element of chance is eliminated." We have made our comparison from the data given on the pages quoted. We may add, however, that neither the Meteorological Office forecasts for February, 1895, nor the weather actually recorded at Greenwich in that month, agree with Mr. Digby's description of them as given in the table.

On page 295 reference is made to a prediction by Mr. Clements of an earthquake which should have occurred on the morning of April 17th, 1898. If this earthquake occurred no one seems to have recognized it, but Mr. Clements gravely tells us that since in April of the eight preceding years, "when the lunar and solar positions were similar, earthquakes occurred in either Greece or Italy, or both, therefore tremors or shocks of greater or less force must have occurred on this occasion also."

At the end of the book are a number of "Rules for Weather Prediction," some of which fairly puzzle us. What, for example, are we to understand when we are told that "to predict the daily height of the barometer for a month, a year, or several years, in advance it is necessary to have the *mean daily* heights for several years in

advance"? Elsewhere in the volume are other statements the exact meaning of which is not self evident; as e.g. when we are told that the "wind force 17" occurred at Greenwich; or again that "the pressure on the square foot was 28 and 36 lbs. respectively on the square inch." Had not the pressure per square inch been quoted elsewhere, more than once, we should have thought the use of the word in this instance accidental; as it is we fear that neither Mr. Clements nor Mr. Digby quite realizes what such figures mean. For the sake of the Astronomer Royal and his staff, not to mention the building itself, we trust the Greenwich Observatory will never have the ill-fortune to be subjected to a wind pressure of 36 lbs. per square inch.

R. H. CURTIS.

The Survey Atlas of England and Wales, a series of 84 plates of maps and plans, with descriptive text, illustrating the topography, physiography, geology, climate, and the political and commercial features of the country. Designed by and prepared under the direction of J. G. BARTHOLOMEW. Under the patronage of the Royal Geographical Society. Edinburgh: J. Bartholomew & Co. Price £2 12s. 6d., in 21 parts at 2s. 6d. each.

THE first part of this Atlas is before us, and the work promises to be as complete and serviceable for England as the similar "Atlas of Scotland" is for the northern kingdom. While the general maps, none of which are included in Part I, will doubtless be full of interest and value, the main ground for recommending the atlas as a whole is in our opinion the unique map of the whole country on the scale of half an inch to a mile. The detail in this map is both full and accurate, while the system of colouring according to altitude allows the physical configuration of the country to stand out in the most real way. Such a map supplies the answer to a multitude of questions regarding climate, for it exhibits at the same time the altitude and the exposure of any given station. The separate sheets have already won their way into the favour of cyclists and motorists, and the atlas when complete will be indispensable in the library of every country house and the study of every meteorologist in England.

METEOROLOGICAL NEWS AND NOTES.

METEORIC STONES have only been seen to fall in the British Isles on four occasions, so far as we are able to ascertain—namely, on December 13th, 1785, near Scarborough; on April 20th, 1876, near Wellington, Shropshire; on March 14th, 1881, at Middlesbrough; and on September 13th, 1902, at Crumlin, near Belfast. The last-named meteorite has just been acquired by the Natural History Department of the British Museum. The stone, which was 7½ inches long, 6½ inches wide, 3½ inches thick, and weighed 9 lbs. 5½ oz., was dug out still hot from a hole about 18 inches deep within a quarter of an hour of the time when it was seen to fall.

SIR JOHN ELIOT, F.R.S., who was knighted on the occasion of the Coronation Durbar at Delhi, on January 1st, will, we understand, resign his position as Meterological Reporter to the Government of India at the end of the present year. Mr. Gilbert T. Walker, of Trinity College, Cambridge, has been appointed Assistant Meteorological Reporter, and will proceed to India to take up his duties at an early date. Mr. Walker, who is a distinguished mathematician and physicist, will, we believe, succeed Sir John Eliot on his retirement.

A WEATHER FORECAST which saved £20,000 is chronicled in the Report of the U.S. Weather Bureau for 1901. On the morning of February 23rd, 1901, a special warning was telegraphed from Washington to Jacksonville, Florida, predicting a frost to occur that night with temperatures of from 20° to 25° F. at Jacksonville, and of 32° as far south as Tampa. More than five hundred telegrams were sent out from the local weather office and the fruit and vegetable growers took precautions to protect the blossom, then at an extremely sensitive stage. The frost came and the damage it would have done, if unforeseen, was estimated at more than 100,000 dollars. It is not often that the money value of scientific prescience can be estimated so definitely.

A REMARKABLE FALL OF DUST was observed at Kew, Invercargill, in the south of New Zealand, during the very wet and stormy weather of October and November last. A correspondent writing on the subject says: "After rain the roof of the house, galvanized iron, was covered with a thick sediment, about half-an-inch deep, of what seemed either volcanic dust, or else dust from the storms in Queensland, which had come down with the rain. It drained off the roof into the water tanks, which had to be emptied and cleaned out before we could get clean water fit for use."

The Abbé Maze.

1836-1902.

THE death of the Abbé Maze, on June 17th, removes an active worker in meteorology, and a prominent member of the French Meteorological Society, who had held the position of Secretary on several occasions. He had also been one of the editors of *Cosmos*, the well-known popular French review of cosmical physics, for nearly thirty years. The published writings of the Abbé were not of much permanent importance; but in announcing his death to the Société de Météorologie, the President stated that he had been engaged in the preparation of a history of the thermometer, for which he had brought together a quantity of material worthy of publication. Another unfinished work was an attempt to establish a periodicity of rainfall in two periods, one of six and one of forty-two years; a memoir on the periodicity of droughts, published at Brussels, in 1895, forming part of this work.

BOOKS RECEIVED.

WE have been unable to find space for the full titles of the following annual reports received last year, and in order to avoid further delay we present the list in an abbreviated form. (The date of publication in each case is 1902.)

Annual Reports of :—

Central Meteorological Observatory of Japan, Part II. for 1897, 1898 and 1899.
Royal Prussian Meteorological Institute for 1891.
Prussian Rainfall Tables for 1897 and 1898 (pub. 1901).
India, Rainfall for 1901.
Mysore, Meteorology for 1901.
Mysore, Rainfall for 1901.
Argentine Republic, Meteorology for 1901.
Ceylon, Meteorology for 1901.
Bouches du-Rhone, Meteorology for 1901.
South Australia, Rainfall for 1899.
Denmark, Nautical Meteorology for 1901.
Denmark, Meteorological Year Book for 1900 and 1901.
Maryland, Magnetic Survey, 1897 to 1901.
Hertfordshire, Meteorology, 1901.
Hertfordshire, Rainfall, 1901.
Margate, Meteorology, 1901.
Dorset, Rainfall, 1901.

Deutsche überseeische meteorologische Beobachtungen Heft XI. Meteorologische Beobachtungen in Deutsch-Ost-Afrika. [Meteorological Observations in German East Africa]. Gesammelt and bearbeitet von Dr. Hans Maurer. Zeil II. Hamburg : Deutsche Seewarte. Size 13 × 10, pp. 272.

Memorandum on the Meteorological conditions prevailing in the Indian Monsoon region before the advance of the south-west Monsoon of 1902, with an estimate of the probable distribution of the Monsoon Rainfall in 1902. By John Murray, M.A. Simla, 1902. Size 13 × 8½. Pp. 27.

The Climate of Hertfordshire, deduced from Meteorological Observations taken during the twelve years 1887–1898. By John Hopkinson, F.L.S. From the "Transactions of the Hertfordshire Natural History Society." Vol. XI., Part 4. Hertford, 1902. Size 5½ × 8½. Pp. 121–134.

Publications of West Hendon House Observatory, Sunderland. No. II. By T. W. Backhouse, F.R.A.S. Sunderland, 1902. Size 11½ × 9. Pp. viii. + 161, 60 plates. [Contains a paper on the frequency and possible periodicity of the aurora borealis.]

Wind Velocity and Fluctuations of Water Level on Lake Erie. U.S. Weather Bureau ; Bulletin J. Prepared by A. J. Henry. Washington, 1902. Size 11½ × 9. Pp. 22 + 26 pp. of plates.

On Rainfall at Batavia as registered by Beckley's Self-Registering Rain Gauge, during 1879–1900, by Dr. S. Figee. Appendix to Vol. XXIII. of the "Observations" of the Royal Observatory at Batavia. Batavia, 1902. Size 14 × 10½. Pp. 21.

Annual Report of the Agricultural Department of the Government of H.H. the Sultan of Zanzibar for 1901. Zanzibar, 1902. Size 7½ × 6. Pp. [32]. [Contains meteorological observations for 1901 at Dunga and Zanzibar Town in Zanzibar Island, and at Banani in Pemba Island.]

Proceedings of the Second Convention of the Weather Bureau Officials, held at Milwaukee, Wis., Aug. 27, 28, 29, 1901. Edited by J. Berry and W. F. R. Phillips, Washington, 1902. Size 9 × 5½. Pp. 246, one plate.

LATE RETURNS IN 1902.

TABLE OF RAINFALL AND TEMPERATURE.

Jan.	Skipton, Arncliffe.....	5·01	—1·37	·97	3	19	..	..	..	..	..	..
June.	Hitchin	3·54	+1·76	·79	12	15	82·0	29	35·0	10	0	..
July.	Broadford, Hurdlestown	1·79	—1·19	·75	25	17	72·0	1&5	44·0	20	0	..
Aug.	Dunrobin	1·31	—1·24	·30	22	9	67·0	24	40·0	11	0	..
Sept.	Glencarron Lodge	7·63	— ·90	2·33	3	20	67·0	3	34·0	19	0	..

SUPPLEMENTARY TABLE OF RAINFALL.

JANUARY.—Scalby, Silverdale, 1·29; Rhayader, Nantgwillt, 3·57; Enniskillen Model School, 3·69.

FEBRUARY.—Enniskillen Model School, 2·35.

MARCH.—Caher, Duneske, 2·24; Enniskillen Model School, 2·41.

APRIL.—Horncastle, Bucknall, 1·77; Keswick, The Bank, 3·87; Enniskillen Model School, 3·26.

MAY.—Shifnal, Hatton Grange, 3·08; Cork, Wellesley Terrace, 1·61; Enniskillen Model School, 2·68.

JUNE.—Bettyhill, 1·84; Enniskillen Model School, 1·68; Belfast, Springfield, 2·74.

JULY.—Ross, The Graig, ·66; Rhayader, Nantgwillt, 3·27; S. Uist, Askernish, 1·55; Enniskillen Model School, 4·17; Belfast, Springfield, 5·08.

AUGUST.—Beltingham, 2·05; Treherbert, Tyn-y-waun, 4·58; Enniskillen Model School, 1·90; Belfast, Springfield, 3·25.

SEPTEMBER.—Ryde, Beldornie Tower, ·66; Beltingham, 1·03; S. Uist, Askernish, 5·75; Miltown Malbay, 1·72; Enniskillen Model School, 3·14.

OCTOBER.—Enniskillen Model School, 2·53; Belfast, Springfield, 1·99.

NOVEMBER.—N. Esk Reservoir [Penicuick], 1·05; Balquhidder, Stronvar, 7·12; Enniskillen Model School, 4·36.

ERRATA.

CLIMATOLOGICAL TABLES.

Oct., 1901.—Cape Town	Min. on grass *should be* ..	not 50·2
Mauritius.....	,, ,, ,,	50·2	,,	65·8
Calcutta	,, ,, ,,	65·8	,,	66·3
Bombay	,, ,, ,,	66·3	,,	71·0
Colombo	,, ,, ,,	71·0	,,	32·0
Melbourne	,, ,, ,,	32·0	,,	35·3
Adelaide	,, ,, ,,	35·3	,,	40·3
Sydney	,, ,, ,,	40·3	,,	..
Wellington	,, ,, ,,	29·0	,,	41·0
Auckland	,, ,, ,,	41·0	,,	..
Grenada	,, ,, ,,	..	,,	22·7
Toronto	,, ,, ,,	22·7	,,	..
Dec., 1901.—Auckland	Abs. max. temp. ,,	75·0	,,	75·5

REGULAR TABLES.

April.	Broadford, Hurdlestown	diff. from aver. *should be*	— ·08	not	+·08
July.	Bury St. Edmunds, Westley ..	,, ,, ,,	—1·69	,,	—·69
Oct.	Aberystwith, Gogerddan	,, ,, ,,	— ·27	,,	—·17

AGGREGATE RAINFALL.

P. 79. Broadford, Hurdlestown ..... diff. from aver. *should be* +1·20 not +1·30

P. 99. Heading *should be* Six months, not Five months.

SUPPLEMENTARY TABLES.

May. Douglas, Woodville, *should be* 3·48, not 3·40

RAINFALL AND TEMPERATURE, JANUARY, 1903.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	On grass.
		inches.	inches.	in.								
I.	London (Camden Square) ...	2·15	+ ·44	·76	4	17	53·8	5	22·1	16	9	1
II.	Tenterden	2·14	+ ·15	·59	4	18	53·2	6	20·0	15	7	1
,,	Hartley Wintney	2·58	+ ·63	·64	4	21	55·0	10	15·0	15	13	1
III.	Hitchin	2·52	+ ·81	·57	4	19	56·0	5	18·0	14*e*	9	
,,	Winslow (Addington)	2·40	+ ·69	·73	4	19	53·0	5	19·0	14	13	1
IV.	Bury St. Edmunds (Westley)	1·90	+ ·21	·40	4	16	52·5	5, 26	19·0	15	...	
,,	Norwich (Brundall)	1·68	+ ·01	·36	19	17	54·8	26	27·5	14	9	1
V.	Winterborne Steepleton	3·91	...	·89	4	20	51·8	4	20·8	15	9	1
,,	Torquay	4·03	...	1·19	4	19	54·9	5	30·0	13*f*	6	1
,,	Polapit Tamar [Launceston]..	5·14	+ 1·81	1·20	4	23	53·8	4	17·5	14	9	1
VI.	Stroud (Upfield)	3·33	+ 1·12	·78	4	20	52·0	6, 27	20·0	14	12	
,,	Church Stretton (Woolstaston)	2·74	+ ·28	·62	4	20	51·5	26	19·0	14	12	
,,	Worcester (Diglis Lock)	...	...	...	...	...	...	...	...	...	...	
VII.	Boston	1·36	— ·02	·41	5	7	52·0	26	18·0	14	...	
,,	Hesley Hall [Tickhill].....	1·69	+ ·28	·47	7	15	55·0	26	14·0	15	13	
,,	Derby (Midland Railway).....	2·00	+ ·40	·35	4	20	53·0	6, 26	22·0	14*g*	12	
VIII.	Bolton (The Park).....	3·20	+ ·15	·47	5	19	51·4	25	24·1	14	11	1
IX.	Wetherby (Ribston Hall) ...	2·21	+ ·55	·45	5	20	...	...	...	...	...	
,,	Skipton (Arncliffe)	9·81	+ 3·43	2·38	26	20	...	...	...	...	...	
,,	Hull (Pearson Park).	1·78	+ ·11	·35	5	19	55·0	26	19·0	13	9	1
X.	Newcastle (Town Moor)	2·63	+ ·82	·58	5	15	...	...	...	...	...	
,,	Borrowdale (Seathwaite).....	18·18	+ 3·33	3·74	26	21	50·5	25	19·4	14	13	
XI.	Cardiff (Ely).....	5·85	+ 2·29	1·70	4	24	...	...	...	...	...	
,,	Haverfordwest	6·11	+ 1·49	1·20	4	24	52·6	5	20·9	13	7	1
,,	Aberystwith (Gogerddan) ...	5·38	+ 1·13	·91	4	17	52·0	6	10·0	13	11	
,,	Llandudno.....	4·49	+ 1·96	·72	26	18	56·0	26	23·8	15	7	
XII.	Cargen [Dumfries]	6·24	+ 1·66	1·32	9	17	51·0	26	18·0	14	13	
XIII.	Edinburgh (Royal Observatory)	3·96	...	1·15	9	22	53·5	26	21·6	15	13	1
XIV.	Colmonell	7·15	+ 2·31	1·10	1, 10	...	54·0	26*a*	18·0	13	12	
XV.	Tighnabruaich	7·91	...	1·45	29	20	46·0	25*b*	20·0	12	13	
,,	Mull (Quinish).....	6·69	+ ·46	·80	9	22	...	...	...	...	...	
XVI.	Loch Leven Sluices	7·20	+ 3·90	1·46	27	17	...	...	...	...	...	
,,	Dundee (Eastern Necropolis)	3·85	+ 1·32	·75	6	19	52·3	25	16·7	14	11	
XVII.	Braemar	4·57	+ 1·79	·65	27	19	47·3	26	1·0	13	17	2
,,	Aberdeen (Cranford)	4·98	+ 2·26	1·62	9	19	53·0	26*c*	14·0	13	13	
,,	Cawdor (Budgate)	4·42	+ 2·20	·76	9	17	..	...	...	...	...	
XVIII	Strathconan [Beauly]	8·72	+ 4·18	1·37	30	18	...	...	...	...	...	
,,	Glencarron Lodge.....	14·01	+ 3·62	3·15	29	20	52·0	26	14·8	13	14	
XIX.	Dunrobin	3·94	+ 1·32	·76	9	14	53·0	29	20·0	14	15	
,,	S. Ronaldshay (Roeberry) ...	2·87	— ·42	·27	30	20	50·0	29	26·0	13	11	
XX.	Darrynane Abbey.....	6·15	+ ·89	·87	8	27	...	...	33·0	11	0	
,,	Waterford (Brook Lodge) ...	6·04	+ 2·52	·93	16	22	53·0	25	24·0	12*h*	9	
,,	Broadford (Hurdlestown) ...	4·67	+ 1·54	1·02	8	25	48·0	25*d*	25·0	11	8	
XXI.	Carlow (Browne's Hill)	4·85	+ 1·78	·65	8	21	...	...	...	...	...	
,,	Dublin (FitzWilliam Square)	3·27	+ 1·13	·58	8	20	55·9	26	25·7	13	7	
XII.	Ballinasloe	4·96	+ 1·52	·83	8	23	53·5	25	...	...	...	
,,	Clifden (Kylemore)	9·26	+ 1·29	1·34	1	21	...	...	...	...	...	
XIII	Seaforde.....	5·14	+ 1·73	1·35	8	18	54·0	25*d*	20·0	12	12	
,,	Londonderry (Creggan Res.).	4·31	+ ·65	·81	9	23	...	...	...	...	...	
,,	Omagh (Edenfel)	6·19	+ 2·68	·75	5	21	53·0	25	16·0	11	12	

+ Shows that the fall was above the average ; — that it was below it.

and 27. b—and 29. c—and 29, 30. d—and 26. *e*—and 15. *f*—and 14. g—and 15, 16. *h*—and 1

SUPPLEMENTARY RAINFALL, JANUARY, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	2·49	XI.	Llandefaelog-fach.....	4·79
II.	Dorking, Abinger Hall .	2·78	,,	New Radnor, Ednol.....	5·50
,,	Sheppey, Leysdown	2·03	,,	Rhayader, Nantgwillt...	8·77
,,	Hailsham	3·05	,,	Lake Vyrnwy	...
,,	Crowborough.....	3·50	,,	Ruthin, Plâs Dràw	3·15
,,	Ryde, Beldornie Tower..	2·09	,,	Criccieth, Talarvor	4·14
,,	Bournemouth, Kempsey	2·44	,,	I. of Anglesey, Lligwy..	5·63
,,	Emsworth, Redlands ...	2·57	,,	Douglas, Woodville.....	5·29
,,	Alton, Ashdell	3·24	XII.	Stoneykirk, Ardwell Ho.	5·00
,,	Newbury, Welford Park	3·51	,,	Dalry, Old Garroch	10·20
III.	Oxford, Magdalen Coll..	2·40	,,	Moniaive, Maxwelton Ho.	8·49
,,	Banbury, Bloxham	2·58	,,	Lilliesleaf, Riddell	5·47
,,	Pitsford, Sedgebrook ...	1·99	XIII.	N. Esk Res. [Penicuick]	5·40
,,	Huntingdon, Brampton.	2·07	XIV.	Dalry, Blair	8·19
,,	Wisbech, Bank House...	1·43	,,	Glasgow, Queen's Park..	7·16
IV.	Southend	1·85	XV.	Inveraray, Newtown ...	10·60
,,	Colchester, Lexden	1·77	,,	Ballachulish, Ardsheal...	11·99
,,	Saffron Waldon, Newport	2·02	,,	Campbeltown, Redknowe	7·53
,,	Rendlesham Hall	2·03	,,	Islay, Eallabus.....	6·70
,,	Swaffham	1·74	XVI.	Dollar.....	5·64
V.	Salisbury, Alderbury ...	2·71	,,	Balquhidder, Stronvar...	...
,,	Bishop's Cannings	3·10	,,	Coupar Angus Station...	3·80
,,	Ashburton, Druid House	6·83	,,	Blair Atholl	5·82
,,	Okehampton, Oaklands.	6·76	,,	Montrose, Sunnyside ...	4·40
,,	Hartland Abbey	5·16	XVII.	Alford, Lynturk Manse..	2·94
,,	Lynmouth, Rock House	6·89	,,	Keith H.R.S.....	3·77
,,	Probus, Lamellyn	4·60	XVIII.	Fearn, Lower Pitkerrie..	2·59
,,	Wellington, The Avenue	4·07	,,	S. Uist, Askernish	5·41
,,	North Cadbury Rectory	3·18	,,	Invergarry.....	12·32
VI.	Clifton, Pembroke Road	4·29	,,	Aviemore, Alvie Manse.	5·63
,,	Ross, The Graig	3·51	,,	Loch Ness, Drumnadrochit	7·86
,,	Shifnal, Hatton Grange	1·82	XIX.	Invershin	3·77
,,	Wem, Clive Vicarage ...	2·05	,,	Bettyhill	4·61
,,	Cheadle, The Heath Ho.	2·34	,,	Watten H.R.S.....	2·81
,,	Coventry, Kingswood ...	2·43	XX.	Cork, Wellesley Terrace	8·07
VII.	Market Overton	1·67	,,	Killarney, District Asyl.	8·30
,,	Grantham, Stainby	1·83	,,	Glenam [Clonmel]	6·75
,,	Horncastle, Bucknall ...	...	,,	Ballingarry, Hazelfort...	4·57
,,	Worksop, Hodsck Priory	2·25	,,	Miltown Malbay	5·88
VIII.	Neston, Hinderton	2·37	XXI.	Gorey, Courtown House	5·16
,,	Southport, Hesketh Park	2·84	,,	Moynalty, Westland ...	5·63
,,	Chatburn, Middlewood.	5·07	,,	Athlone, Twyford	4·91
,,	Duddon Val., Seathwaite Vic.	9·35	,,	Mullingar, Belvedere ...	6·45
IX.	Langsett Moor, Up. Midhope	4·32	XXII.	Woodlawn	5·47
,,	Baldersby	2·48	,,	Westport, Murrisk Abbey	5·77
,,	Scalby, Silverdale	2·04	,,	Crossmolina, Enniscoe ..	6·79
,,	Ingleby Greenhow Vic..	3·08	,,	Collooney, Markree Obs.	5·34
,,	Middleton, Mickleton ...	5·12	XXIII.	Enniskillen, Portora ...	5·13
X.	Beltingham	4·28	,,	Warrenpoint.....	5·79
,,	Bamburgh	2·04	,,	Banbridge, Milltown ...	4·30
,,	Keswick, The Bank.....	10·70	,,	Belfast, Springfield	5·33
,,	Melmerby Rectory	3·82	,,	Bushmills, Dundarave..	5·79
XI.	Llanfrechfa Grange	6·25	,,	Stewartstown	6·64
,,	Treherbert, Tyn-y-waun	13·88	,,	Killybegs	5·98
,,	Castle Malgwyn	6·03	,,	Horn Head	6·17

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1902.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	79·9	29	44·0	11	71·2	53·0	53·9	75	122·8	39·3	3·69	18	7·2
Malta	99·3	10	64·9	15	88·9	71·3	66·1	65	148·3	60·2	·00	0	0·6
Cape Town	69·2	22	38·3	18	61·9	48·8	48·6	79	...	...	3·88	20	5·5
Durban, Natal	79·0	12	48·4	19	73·4	55·9	...	...	131·5	...	3·90	12	4·3
Mauritius	80·3	8	51·9	12	78·5	62·0	60·7	74	145·0	63·5	·58	11	...
Calcutta	94·2	13	74·7	11	89·8	78·6	77·8	83	159·0	73·7	14·01	16	8·1
Bombay	88·2	7	74·4	21	85·8	78·3	76·0	82	139·7	73·5	16·53	24	7·5
Madras	100·3	3	72·9	25	93·8	77·7	74·4	76	153·0	72·4	3·26	14	6·5
Kodaikanal	67·5	11	50·9	29	64·2	53·4	52·9	85	142·7	43·8	4·01	16	7·7
Colombo, Ceylon	89·2	4*a*	75·0	17	87·5	78·1	74·6	81	150·0	72·0	2·76	13	6·9
Hongkong	90·6	30	74·2	10	86·9	77·4	75·8	83	145·5	...	26·51	17	6·1
Melbourne	68·5	29	29·6	14	56·2	39·7	40·8	78	125·0	21·3	·88	9	5·9
Adelaide	70·1	19	39·0	8, 25	61·8	44·3	42·6	71	127·7	31·2	1·13	13	5·6
Coolgardie	77·0	31	34·0	7	66·8	43·2	45·0	70	142·2	27·8	1·71	5	3·4
Sydney	65·1	30	40·3	1	59·4	46·9	45·6	83	101·9	31·8	6·32	20	5·1
Wellington	61·0	18*b*	35·0	31	54·6	42·6	40·7	73	100·0	28·0	2·06	19	5·4
Auckland	62·5	7	39·0	4	56·5	44·7	40·1	67	130·0	37·0	2·33	16	4·6
Jamaica, Negril Point	89·9	1, 9	70·9	6	87·6	73·0	73·6	78	...	...	6·77	14	...
Trinidad	90·0	15*c*	70·0	8	86·9	72·2	77·1	93	168·0	67·0	11·67	19	...
Grenada	86·0	17	70·0	21	83·7	74·6	70·6	76	146·4	...	12·12	26	3·2
Toronto	85·2	3	47·0	16	75·2	55·8	56·8	77	106·0	38·0	2·38	10	4·7
Fredericton, N.B.	83·9	1	39·5	28	73·1	52·7	53·9	63	...	...	3·50	13	5·9
Winnipeg	91·2	5	38·3	21	77·6	50·9	...	...	...	...	·93	7	5·0
Victoria, B.C.	84·4	9	46·2	29	68·8	52·7	...	...	...	...	·43	4	3·2
Dawson	72·4	1, 9	34·5	28	66·3	44·7	...	...	...	...	2·15	12	5·4

a—and 11, 25. *b*—and 21. *c*—and 18.

MALTA.—Mean temp. of air 79°·2, or 1°·3, above average. Mean hourly velocity of wind 6·9 miles or 0·5 below average. Mean temp. of sea 81°·2. J. F. DOBSON.

Mauritius.—Mean temp. of air 1°·2 above, dew point 1°·2 above, and R 1·79 in. below, and mean hourly velocity of wind 2·3 miles below their averages. T. F. CLAXTON.

MADRAS.—Mean temp. of air 0°·7 above, humidity 6 above and R 5·43 in. below average, sunshine 106·0 hours, or 27·4 per cent. of possible amount. A. MOFFAT.

KODAIKANAL.—Bright sunshine 112·3 hours. A very cloudy month. C. MICHIE SMITH.

COLOMBO.—Mean temp. of air 1°·7 above, of dew point 1°·5 above, and R ·92 in. below their averages. Mean hourly velocity of wind 8 miles. H. O. BARNARD.

HONGKONG.—Mean temp. 81°·8. Bright sunshine 231·2 or 34 hours above average. R 11·65 in. above average. Mean hourly velocity of wind 10·2 miles. F. G. FIGG.

Adelaide.—Mean temp. 53°·0 or 0°·9 below, and R 1·13 in. below their averages. Except in the extreme S.E. R was from 40 to 70 per cent. short of the average. Highest mean bar. in August for 45 years (30·30). C. TODD, F.R.S.

Sydney.—Mean temp. 1°·6 below, humidity 9°·3 above, and R 3·10 in. above their averages. H. C. RUSSELL, F.R.S.

Wellington.—Mean temp. 0°·6 above and R 3·14 in. below averages. R. B. GORE.

Auckland.—Mean temp. 2°·1 and R quite 2 in. below averages. T. F. CHEESEMAN.

Trinidad.—R 1·54 in. above the 40 years' average. J. H. HART.

SYMONS'S

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THE GREAT DUSTFALL OF FEBRUARY, 1903.

BETWEEN the 21st and 23rd of February observers in nearly all parts of Wales and southern England reported a fall of atmospheric dust, or muddy rain, similar to that which occurred in the south-west of England and Wales on January 22nd, 1902. This together with the abnormally steep barometric gradients, the severe gales and the remarkable mildness, makes the month of February just past more than usually interesting from a meteorological point of view, and makes us feel the restricted space at our disposal despite the enlargement of this number. The fall of dust is remarkable in several ways. It was far more extensive in its distribution than that of last year, and at most places considerably more intense, for it was quite as frequently observed in the form of a dense dry fog as in that of muddy rain.

We are greatly obliged to many correspondents for their kindness in forwarding particulars of the phenomenon and samples of the dust, and we have endeavoured to acknowledge this kindness by preparing a preliminary report on the distribution of the dustfall at the earliest possible opportunity. A complete discussion has been undertaken, and will be carried out by collaboration between the Meteorological Office, the Royal Meteorological Society and the British Rainfall Organization. This will necessarily be a work of time, and at present, pending the microscopic examination of the numerous samples received, we express no opinion as to the origin of the dust beyond stating that, until the contrary is proved, this dustfall, like those of 1901 and 1902, may be assumed to come from the deserts of northern Africa. The similarity in appearance of dust collected on the same day at points hundreds of miles apart disproves the possibility of any local origin, and the simultaneous fall over England, Holland, Belgium, Germany, Switzerland and Austria, suggests that the origin lay somewhere beyond the borders of Europe.

We have received from correspondents, and through the newspapers, reports of more than 200 cases of the fall of dust in 32 counties in England and Wales, and one in Ireland, a list of which is appended, and although the names of the observers are omitted on

account of exigencies of space, we have pleasure in repeating to all the expression of our hearty thanks, which we have already sent to each.

The accompanying map shows the observed distribution of the dustfall over the British Isles. The scale does not admit of the stations being shown by separate dots, but it may be assumed that dust fell over the whole of the shaded area. The outline of that area was drawn on a large-scale map, where the position of each station reporting dust was marked, by drawing the line so that it was always within 10 miles of one of the stations. In other words, no part of the shaded area is more than 10 miles distant from a recorded case of dustfall on one of the days in question. Isolated instances (Leicester and Cavan) are shown by dots, and two cases where the date did not correspond with the majority of instances are marked with a query.

THE DUST FALL OF FEBRUARY, 1903.

It must be remembered that absence of information does not necessarily mean that no dust fell; although in some places, such as Somersetshire, where there are many careful rainfall observers who state definitely that they noticed nothing, it is very probable that the fall did not take place. In mid-Wales, on the other hand, where there is a very sparse population and extremely few observers, it is quite likely that the phenomenon might occur without attracting attention. It may be stated with confidence that dust fell over the greater part, if not quite over the whole, of the country from Falmouth to the South Foreland and from North Wales to Norfolk, the total extent being 300 miles from west to east and 200 miles from north to south. It appears that the dust fell most thickly in two areas, South Wales and the Weald district of Kent, Surrey and Sussex.

As to the nature of the actual fall, we have only space to cite the following typical descriptions which are samples of many :—

Mrs. Foster writes from Witley, Godalming :—"On Saturday, February 21st, we had a remarkable dust-storm, worst about midday. The wind was very high at 7 a.m. and continued so all day, there was also a great "fog," which is unusual with a high wind, though we do sometimes get "sea-fret" with a southerly wind. Several people who went out of doors complained of the dreadful dust in their eyes and nostrils, and on interrogating our gardener, who has lived here for over 30 years, I learned that the supposed fog was not damp but dry, very fine dust, and he had never seen anything like it before. On Monday morning, after the rain of Sunday, the 22nd, I saw yellow dust on the south and west window sills, but it was like cement and could not be swept up, so it had to be washed off."

Dr. Edwin Freshfield states that at Juniper Hill, near Reigate :—"On Saturday, February 21st. the wind from 9 to 11 a.m. was W.S.W. to S.S.W., and increased in severity to sundown when it shifted to W., fell later, and calmed by 9 p.m. From 9 a.m. till 2 p.m. the sun was shining brightly through a haze similar to the Khamsin haze in Egypt, then the semi-obscured sky cleared of mist about 4 p.m. Evergreen trees were noticed to be covered with chocolate-coloured dust at 11 a.m., and by 4 p.m. the trees were all of one uniform colour. The dust was silky to the touch, slightly iridescent and must have fallen between sunrise and 4 p.m. No rain fell till 9 p.m."

Mrs. Silver writes from Highfield Vicarage, Southampton :—"On Sunday, February 22nd, between 11 a.m. and noon the sky was completely covered with a thick yellow cloud exactly like a London fog, too thick for sufficient light to penetrate to read by. The darkness lasted about an hour, and when it had passed the windows which had, I suppose, been damp were covered with yellow sand. North, east and south were equally covered, and the upper storeys were as dirty as the lower ones. The backs of the chairs in the garden were also covered with a layer of yellow sand, which adhered to the wood where it was damp."

Mr. G. D. Hope writes from Havering Grange, near Romford :—"On Saturday, 21st February, a great amount of gray dust fell at Havering, and owing to the previous showers adhered to the branches and stems of the trees, hedges, buildings, etc. The conifers collected most, and looked as if they had been powdered with flour. The dust did not fall with the rain, but before it. It came from the west and south-west in all cases and adhered only to that side of the trees, etc."

Mr. E. E. Glyde writes from Whitchurch, Tavistock :—"On Sunday morning, February 22nd, at 9 a.m., I found the water in my rain-gauges very discoloured, especially that registered since 9 p.m. on the 21st. A buff or reddish-yellow sediment lay at the bottom of

FIVE MONTHS WINTER RAINFALL, OCTOBER, 1902—FEBRUARY, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Station.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	—2·17	78	Arncliffe	+4·62	115	Braemar	+6·92	143
Tenterden	—1·52	87	Hull	—1·51	86	Aberdeen	+ ·31	102
Hartley Wintney	—1·18	89	Newcastle	— ·27	98	Cawdor	+2·04	116
Hitchin	—2·00	80	Seathwaite	+5·01	107	Glencarron	+6·37	113
Winslow	—2·71	74	Cardiff	+1·43	108	Dunrobin	—1·67	89
Westley	—4·00	62	Haverfordwest	+1·62	107	Darrynane	—2·52	90
Brundall	—3·95	62	Gogerddan	— ·49	98	Waterford	+3·63	120
Alderbury	—1·54	89	Llandudno	+ ·41	103	Broadford	+1·81	112
Ashburton	+ ·03	100	Dumfries	+3·68	117	Carlow	+2·67	117
Polapit Tamar	+2·83	116	Lilliesleaf	+4·16	131	Dublin	+1·43	112
Stroud	— ·42	96	Colmonell	+2·13	110	Mullingar	+3·99	125
Woolstaston	— ·46	97	Glasgow	+6·54	138	Ballinasloe	+2·11	113
Boston	—1·79	79	Inveraray	+3·61	110	Clifden	— ·59	98
Hesley Hall	— ·81	91	Islay	+ ·33	101	Crossmolina	+2·38	109
Derby	— ·43	95	Mull	+2·71	110	Seaforde	+3·63	121
Bolton	+1·14	107	Loch Leven	+5·90	135	Londonderry	— ·04	100
Wetherby	+2·17	122	Dundee	+1·41	111	Omagh	+2·95	117

With exceptions that hardly require notice the rainfall in February (see Table on p. 36) was well below the average in south and central England, where Camden Square and Addington, Winslow, had little more than half the average fall of the month, while Boston had just about one-third and Westley, near Bury St. Edmunds, and Brundall, near Norwich, had barely one-fifth. On the other hand, the rainfall of Ireland, the north of England and Scotland was far above the average, at Seathwaite the fall for the shortest month of the year reached the enormous total of almost 21 inches, or one and three quarters of the average, while Arncliffe, near Skipton, had nearly twice its average fall. These figures, however, become insignificant compared with the enormous excesses of rainfall in Scotland, where Braemar had more than two and a half times, and Loch Leven two and three quarter times their usual February fall.

The result of this condition of things (which is fully explained by the barometrical conditions described in Mr. Brodie's letter) is that the irregularity of the cumulative winter's rainfall referred to last month, has been rendered more remarkable. Speaking generally, the winter's rainfall has been below the average over the whole of eastern and central England, and above the average in Cornwall, Devon, Somerset, Wales, the north of England, Scotland and Ireland. The centre of greatest deficiency is in East Anglia, where less than two-thirds of the normal supply of the ten years, 1890-99 (a period in itself very dry), has been received. The centre of greatest excess is in the centre and south of Scotland, where the rainfall for the five winter months exceeds the ten years' average by one-third, and in that part of the country the ten year period in question had a normal rainfall.

THE FORCE OF THE WIND DURING THE GALE OF FEBRUARY 26TH–27TH.

THE maximum wind forces recorded during the gale of the 26th and 27th of February, 1903, were suchas to justify us in regarding it as one of the most seVere storms which has visited the British Isles for several years.

As is usually the case with gales which reach us from the south-west or west, the strongest forces were felt almost exclusively in the districts adjacent to our western littoral, and a quite remarkable agreement is shown in the maximum wind velocities registered over that part of the kingdom by pressure-tube anemometers, which are the only instruments by which at present this feature of wind-force can be satisfactorily measured.

At Pendennis Castle, which faces the sea at the entrance to Falmouth harbour, a maximum rate of 88 miles per hour was reached just before midnight of the 26th, and the rate exceeded 80 miles per hour many times between 9 p.m. on the 26th and 1 a.m. on the 27th, when the gale began to subside. At Holyhead the maximum rate was 87 miles per hour, recorded five hours later than the extreme at Falmouth, and here the force began to decrease at 6 a.m. At Bidston the maximum velocity of the gale probably missed registration owing to the supply of ink in the pen of the pressure-tube anemometer failing, and the highest velocity recorded was only 78 miles per hour, at 5.20 a.m. At Southport the extreme rate reached was 92 miles per hour, at about 6 a.m. on the 27th.

These very high velocities correspond to a wind-pressure of from 23 lbs. to 25 lbs. per square foot; and the actual pressures recorded at Holyhead and at Southport, by pressure-plate anemometers constructed to eliminate the large inertia errors, which there is good reason for believing always exist in the Osler instrument, were 23 lbs. and 28 lbs. respectively, thus agreeing very closely with the pressure-tube results. At Bidston, however, a pressure of 47 lbs. was registered by the Osler plate, and this, although a high record, is considerably below many pressures which have been registered there in previous gales apparently not more severe than this.

Along the south coast the recorded velocities were considerably lower. At Rousdon the maximum was only 61 miles, which is less than might have been expected seeing that at Shoeburyness it reached a rate of 73 miles per hour, which is equal to a pressure of 16 lbs. per square foot. At Greenwich the Osler plate recorded 33 lbs. per square foot, or four pounds less than it did two days earlier, in a gale which at Shoeburyness and at Kew was much less severe than that under discussion. The explanation of this anomaly is found in the fact that the extent to which the records of such instruments as that still used at Greenwich are exaggerated, depends a good deal upon the way in which, after having been struck by a gust, the vibrating plate is "followed up" by other gusts immediately succeeding the first.

A few years ago a portion of a train passing along an exposed part of a "light" railway on the Kerry coast was overturned by the wind; but so far as we know—with the exception of the Tay Bridge accident in 1879, when the wind was only one contributing cause amongst others—that is the only instance in which such an accident has occurred on any railway in the British Islands since 1867, when a brake van and a Post Office van were blown over upon their sides, after the train of which they formed a part had been brought to a standstill by the wind, upon an exposed bank not far from Aber in North Wales.

In the present gale, however, the wind was able to surpass that feat and to overturn ten passenger coaches and vans, whilst a train was on the Leven viaduct, near Ulverston. The force required to overturn an ordinary railway carriage may be taken as about 30 lbs. per square foot, so that a squall not much stronger than the strongest recorded at Southport was probably all that was needed to do the damage on this occasion, especially as the train was not heavily laden.

The Robinson cup anemometers do not record the extreme force of the wind; but the mean hourly velocities they registered during the gale were from 60 to 66 miles per hour (true), the latter amount being the record at Kingstown, in which neighbourhood, and in Dublin, much damage was wrought by the gale. On the east coast of England the force recorded was much less, and in the Orkneys the gale was by no means severe. R. H. C.

Correspondence.

THE GALE OF FEBRUARY 27TH.

To the Editor of Symons's Meteorological Magazine.

As the Marshside anemograph station of this observatory appears to have been exposed to the full force of the recent "storm" (force 11), the following hourly velocities of the wind, deduced from the traces of the Dine's pressure tube recording anemometer, may possibly be of interest to some of your readers. Following the Meteorological Office system, the values are in each case the means for the period from 30 minutes before until 30 minutes after the exact hour. The directions have been obtained in the same way from the traces of my recording anemoscope.

February 27th, 1903.

	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.
Velocity in miles..	37	36	38	47	50
Direction	S.S.E.	S. by E.	S. by W.	S.W.	S.W.
	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.
Velocity in miles...	63	67·5	66	59	53
Direction	S.W. by W.	S.W. by W.	S.W. by W.	W.S.W.	W.S.W.
	11 a.m.	Noon.	1 p.m.	2 p.m.	3 p.m.
Velocity in miles...	50	44	39	36	31
Direction	W.S.W.	W.S.W.	W.S.W.	W.S.W.	W.S.W.

By midnight the velocity had fallen to 13 miles, and the direction had veered to W. by N. The rate of movement during the strongest momentary gust was 92 miles per hour, there being, in all, four gusts of 90 miles or upwards.

The maximum pressure registered by Dine's non-oscillating pressure plate anemometer was 28·8 lbs. per square foot. This is higher than the 92 miles would represent, though the maxima from our improved forms of the two instruments now usually agree very closely. The probability would appear to be that the plate, although mounted somewhat below the "head" of the tube, was struck by a stronger gust than any encountered by the latter.

JOSEPH BAXENDELL.

The Fernley Observatory, Southport, March 3rd, 1903.

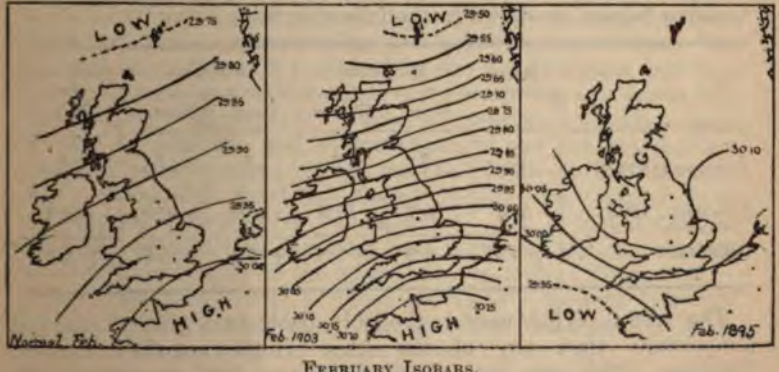
ATMOSPHERIC PRESSURE IN FEBRUARY.

To the Editor of Symons's Meteorological Magazine.

In connection with the very exceptional weather of last month the accompanying little maps may, perhaps, be of some interest. Each map shows by isobars, drawn for every half-tenth of an inch, the monthly mean distribution of barometrical pressure over the United Kingdom at 8 a.m.

Map 1 gives the normal distribution in February, and is based upon the 30 years' average 1871–1900. It will be seen that in an average February the mean pressure ranges from a little above 30·00 inches over the eastern part of the English Channel to about 29·75 inches in the Shetlands, the distribution being favourable for moderate breezes from the south-westward.

Map 2 shows the distribution of mean pressure as it existed last month. In this case the values ranged from about 30·25 inches over the southern part of the Channel to about 29·90 inches in the Shetlands. The general trend of the isobars was very similar to that shown in the normal map; but as the actual values in the extreme



FEBRUARY ISOBARS.

south were nearly a quarter of an inch above the average, while those in the extreme north were just as much below it, the barometrical gradient for south-westerly winds was immensely steeper in 1903 than in the normal February. In the normal map only six isobars are shown, while in that for February, 1903, there are no fewer than sixteen, the actual difference in pressure from south to north being nearly three times as great as usual. So striking a result was due to the fact that in the course of the month an almost constant succession of cyclonic systems swept past our north-western and northern coasts, each disturbance causing a great depression of the barometer in those regions and thus leading, in a cumulative way, to the reduction shown by the monthly mean values. According to the map the south-westerly winds should have blown last month with three times their usual strength; and, if they did not quite do this, their constant presence was sufficient to give us an exceptionally high mean temperature, with frequent heavy rains in the west and north, and especially along the Atlantic seaboard.

As a matter of curiosity I reproduce in Map 3 the pressure conditions existing in February, 1895—a month, it will be remembered, of intense frost and burst water-pipes, but of little rain. In that case the mean distribution was distinctly anticyclonic, the area of lowest pressure having been shifted from its usual place in the north to the neighbourhood of our south-west coasts. Maps 2 and 3 afford a striking example of the weather possibilities our changeable climate is capable of affording.

FREDK. J. BRODIE.

12, Patten Road, Wandsworth Common, S. W.,
9th March, 1903.

THE HIGH TEMPERATURE OF FEBRUARY, 1903, IN LONDON.

THE persistently mild character of the past month is strikingly brought out by an examination of the records of temperature at Camden Square, as shown in the following table :—

	Mean temp.	Maximum.		Minimum.		Earth temp. 1 foot. Mean.
		Mean.	Highest.	Mean.	Highest.	
	°	°	°	°	°	°
Average (1858-97)...	39·8	45·5	55·2	34·7	45·4	38·9
February, 1903.....	45·1	50·8	59·0	40·0	52·0	42·4
Difference	+ 5·3	+ 5·3	+ 3·8	+ 5·3	+ 6·6	+ 3·5

The month of February is probably liable to a greater range of temperature than any of the other winter months; and, as February, 1895, was the coldest, February, 1903, seems to have

been almost, if not quite, the warmest winter month since observations were commenced in 1858. The mean temperature, 45°·1, has only been exceeded in 1867 with 45°·3, and in 1869 with 45°·9, during the 45 years. The mean shade maximum, 50°·8, was passed in 1869 with 51°·7, and in 1872 with 51°·1; but the absolute maximum, 59°·0, has been surpassed on six occasions, the highest being the remarkable reading of 64°·8 on February 10th, 1899. The most notable figures in 1903, however, occur among the shade minima; for although the mean, 40°·0, was very slightly exceeded in February, 1867, with 40°·2, and in 1869 with 40°·6, it has not once been reached in March, and is 0°·3 higher than the average for April. The highest minimum reading, 52°·0, on 21st, has never been approached in February or March, and is a figure rarely attained in April. The earth temperatures supply a good indication of protracted warmth, particularly with respect to its effect on vegetation, and though the mean, at 1 foot below the surface, 42°·4, was no higher than in 1872 (43°·1) and 1877 (42°·4), the figure exceeded the average for March by 1°·7.

Coupled with the almost rainless weather of the first three weeks, the high temperature imparted to the month a prematurely spring-like aspect, to be rudely dispelled by the storms and rain of the last week.

THE CANADIAN CLIMATE.

By R. F. STUPART, Director Meteorological Service, Dominion of Canada.

(*Continued from p. 4.*)

THE summers of western Quebec are as warm as in western Ontario; in July the 70° isotherm passes not far south of Montreal, the 65° line passes through Quebec City, and most of the Gaspé Peninsula has a mean temperature somewhat below 60°. The winters are cold, but dry and bracing, and may very fairly be compared with those of St. Petersburg and Moscow. Zero temperatures, while not infrequent, are not the rule, and it is only on a few occasions in each winter that exceedingly cold dips are experienced. The third week in April sees the trees along the St. Lawrence budding, and it is not until late in November that the last red sear leaves fall.

The opening of spring in the maritime provinces is usually a little later than in southern and western Ontario and the North-West Territories, and somewhat earlier than in the lower St. Lawrence Valley; on the other hand, the summer lingers longer, especially in the Annapolis Valley. The summers are, as a rule, not quite so warm as in western Canada, great heat being seldom experienced, except very occasionally in the inland stations of New Brunswick.

The average precipitation of these provinces is between forty and forty-five inches, except along the southern coast-line of Nova Scotia, where it is nearly ten inches greater.

A trip through the Annapolis Valley in Nova Scotia in October

will amply repay the tourist, as nothing can be conceived more beautiful than the gorgeous autumn tints which everywhere enhance the loveliness of the landscape; but whether in the land of Evangeline or in the region of the great fresh water seas which lave Ontario's shores, the unbiassed individual must allow that in truth the most salient feature of Canada's climate is not the cold of winter, but the perfection of the summer and autumn.

The whole of Canada, with the exception of near the coast in British Columbia, is favoured with more sunshine than any portion of Great Britain, Germany, Holland or northern France. Nearly all parts of the Dominion have an annual percentage of over 40, and a summer percentage of between 53 and 59, whereas it is only in the more southern parts of England that a normal annual percentage of 36 is reached, and the summer figures, while in a few instances up to 50, are more generally between 35 and 45. At German stations the August maximum averages under 50 per cent., and in a few cases reaches 52. In the south of Europe much higher values are obtained: Vienna 54, Zurich 57, Trieste 66, Lugano 67, Rome 75, Madrid 84. These figures show that it is only the southern parts of Europe that have more sunshine than Canada.

A few facts regarding the climate of the "Golden" Klondyke may, perhaps, be acceptable to some persons. Its geographical position is as follows:—Yukon Territory has nearly the shape of a right-angled triangle, of which the base is an arc of the 60th parallel, the perpendicular an arc of the 141st meridian, and the hypothenuse the Rocky Mountains. To reach the Klondyke the traveller now lands at Skagway on the Pacific coast, crosses the coast range of mountains by railway, passing through superb scenery, and then has a trip of 430 miles by steamer down the Yukon River. The distance from Toronto to Dawson City is 2700 miles as the crow flies.

A somewhat broken series of observations at Dawson and various other places in Yukon Territory between 1895 and 1898, and a continuous series at Dawson during the past three years, afford data for estimating with a fair degree of accuracy the average climatic conditions of the Klondyke. The average annual mean temperature is about 22°; the mean of the three summer months is about 57°, July being 61°; and of the three winter months, —16°, with January, —23°. Spring may be said to open towards the end of April, the last zero temperature of the winter usually occurring about the 5th of that month. May, with an average temperature of 44°, is by no means an unpleasant month, and the 23rd is the average date of the last frost of spring. Daily observations during five summers indicate that, on the average, the temperature rises to 70° or higher on 46 days, and to 80° or higher on 14 days; 90° was recorded in Dawson in June, 1899, and 95° in July of the same year. These temperatures, with much bright sunshine and an absence of frost

during three months, together with the long days of a latitude within a few degrees of the Arctic Circle amply account for the success so far achieved by market gardeners near Dawson in growing a large variety of garden produce, including lettuce, radish, cabbage, cauliflower and potatoes, and warrant the belief that the hardier cereals might possibly be a successful crop, both in parts of the Yukon Territory and in the far northern districts of the MacKenzie Basin. August 23rd would appear to be the average date of the first autumnal frost, the temperature rapidly declining towards the close of that month. Although night frosts are not infrequent in September, the month as a whole is mild with a mean temperature of 42°. October may be fairly termed a winter month, the mean temperature being but 22°·5, and the first zero of the winter is recorded on the average about the 18th. Ice usually begins to run in the Yukon about the second week of October, but it is not until quite the end of the month, or early in November, that the river is frozen fast. The temperature on the average during a winter falls to 20° below zero or lower on 72 days, to 40° below or lower on 21 days, to 50° below or lower on 7 days, and to 60° below or lower on 2 days. In January, 1896, 65° below zero was registered at Fort Constantine, and in January, 1901, —68° was recorded at Dawson.

Observations of rain and snow have until the close of last summer been very fragmentary, but it is probable that the summer rainfall near Dawson is usually between seven and nine inches, and that the total snowfall of autumn and winter is between fifty and sixty inches.

Dawson being situated near the river, with high hills or mountains on all sides, is well protected from the winds, and a feature of the town, and, indeed, of the neighbouring country, is the occurrence of long periods of calm weather.

(*To be continued.*)

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting was held on Wednesday evening, February 18th, at the Society's rooms, 70, Victoria Street, Westminster. Capt. D. Wilson-Barker, President, in the chair.

The following gentlemen were elected Fellows of the Society :— Mr. Hari D. Das, Mr. H. E. Goldsmith, Mr. W. G. Groves, Khan Bahadur A. Lateef, Dr. G. Oliver, and Dr. P. Horton Smith.

The President announced the death of Mr. J. Glaisher, F.R.S., on February 7th, and spoke of the valuable services which he had rendered to English meteorology.

Mr. A. Brewin, as one of the oldest Fellows in the Society, and a personal friend of Mr. Glaisher, moved the following resolution :—

"The Council and Fellows of the Royal Meteorological Society have heard with regret of the death of Mr. James Glaisher, F.R.S., who was one of the founders of the society. He held the office of

Secretary from 1850 until 1872, excepting for the two years 1867-8, when he was President, and he was a member of Council in 1873. The Council and Fellows desire to record their high sense of the valuable assistance which Mr. Glaisher rendered to the society in the early years of its existence, and of his great and long continued service in the promotion of the science of meteorology. The Council and Fellows desire to express their sympathy with his son, Dr. J. W. L. Glaisher, F.R.S."

The resolution was seconded by Mr. R. Inwards, supported by Mr. H. Southall and Mr. W. Marriott, and unanimously agreed to.

Mr. E. Mawley read his "Report on the Phenological Observations for 1902." In all parts of the British Isles the phenological year ending November 30th was generally cold and sunless. Rain fell at unusually frequent intervals, so that although the total quantity proved deficient, there were no periods of drought. Wild plants were everywhere behind their mean date in coming into flower, but the departures from the average were as a rule slight, until about the middle of May. After that time until the end of the flowering season the dates of the blossoming were later than in any other year since the present series of records was instituted except 1891 and 1900, as will be seen from the accompanying table.

Mean results for 13 plants.

ENGLAND.

Year.	S.W.		South.		Midlands.		East.		N.W.	
	Day of year.	Diff. from average.	Day of year.	Diff. from average.	Day of year.	Diff. from average.	Day of year.	Diff. from average.	Day of year.	Diff. from average.
		Days.		Days.		Days.		Days.		Days.
1891...	144	+10	144	+ 9	150	+11	147	+11	150	+ 7
1892...	139	+ 5	138	+ 3	144	+ 5	143	+ 7	147	+ 4
1893...	118	—16	122	—13	125	—14	123	—13	128	—15
1894...	126	— 8	130	— 5	135	— 4	127	— 9	137	— 6
1895...	139	+ 5	138	+ 3	141	+ 2	138	+ 2	144	+ 1
1896...	125	— 9	128	— 7	132	— 7	130	— 6	134	— 9
1897...	130	— 4	132	— 3	136	— 3	132	— 4	142	— 1
1898...	133	— 1	135	0	138	— 1	136	0	141	— 2
1899.	136	+ 2	136	+ 1	141	+ 2	138	+ 2	145	+ 2
1900...	142	+ 8	141	+ 6	144	+ 5	143	+ 7	152	+ 9
1901...	138	+ 4	139	+ 4	141	+ 2	139	+ 3	144	+ 1
1902...	139	+ 5	140	+ 5	145	+ 6	142	+ 6	152	+ 9
Mean	134	...	135	...	139	...	136	...	143	...

— signifies *early*, and + *late*.

The swallow, cuckoo, and nightingale were a few days earlier than usual in making their appearance.

The most remarkable feature as regards the weather and its effect on vegetation was the way in which it favoured the growth of all farm crops, except potatoes and hops, for it is seldom that in the same year the yield of wheat, barley, oats, beans, peas, turnips, mangolds and grass, is alike abundant, even in a single district, much less in all parts of the kingdom, as was the case in 1902. On the other hand, all the fruit crops were more or less deficient, with the exception of strawberries, which yielded well, but were, like most other fruits, lacking in flavour.

The President, Mr. R. G. K. Lempfert, Mr. H. Southall, Mr. R. H. Curtis, Mr. C. Harding, and Mr. W. Marriott, took part in the discussion, and Mr. E. Mawley replied.

METEOROLOGICAL NEWS AND NOTES.

THE SCOTTISH ANTARCTIC EXPEDITION will, contrary to the original plan, endeavour to find a safe wintering place as far south as possible in the Antarctic regions south of South America, and spend the next six months in a high latitude. Mr. Mossman writes that he is looking forward to this opportunity for securing a unique series of records of polar weather. As yet he has been able to reduce and discuss his observations on the voyage out, month by month, and this he hopes to continue to do, so that they will be ready for immediate publication on his return.

THE INTERNATIONAL COUNCIL FOR THE STUDY OF THE SEA met for the second time at Copenhagen in the last week of February. The question of meteorological observations, with special reference to kite-work at sea, was discussed by an informal committee consisting of the representatives interested in physical work, which included Dr. Nansen (Christiana), Professor Pettersson (Stockholm), Professor Homén (Helsingfors), Dr. Knudsen (Copenhagen), Professor Krümmel (Kiel), Dr. Wind (de Bilt), Professor Gilson (Louvain), and Dr. H. R. Mill (London). It is understood that a great deal of information as to the surface temperature of the North Sea has already been obtained by means of observations carried out on board the regular trading steamers, which will continue to supplement the quarterly cruises of the ten special research steamers of the associated countries.

CYCLES OF RAINFALL IN UTAH are discussed by Mr. L. H. Murdoch in the *Monthly Weather Review* for October, 1902. He carries back the curve of rainfall fluctuations to 1827, by utilizing the relation between the level of Great Salt Lake and the amount of rainfall, which is very intimate and sympathetic. An extremely dry period prevailed from 1827 to 1863, in the latter year the fall was as little as 7 in., the lowest recorded; in 1867 it was 28 in., the highest recorded, and until 1879 it never fell so low as 16 in.; since that time it has never been so high as 20 in., and twice has been as low as 11 in. In view of the immense money value of a knowledge as to how long the present dry period may last, the author endeavoured to trace a relation between sunspot and other natural cycles and the rainfall, but without success.

RAINFALL AND TEMPERATURE, FEBRUARY, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·83	— ·64	·30	27	10	59·0	20	25·7	18	4	
II.		Tenterden	1·39	— ·31	·77	27	8	59·8	20	27·0	2	4	1
,,		Hartley Wintney	1·37	— ·26	·37	27	14	58·0	20	27·0	2	7	
III.		Hitchin	1·03	— ·43	·24	24	12	59·0	9	25·0	17	6	
,,		Winslow (Addington)	·76	— ·70	·28	24	9	60·0	19	26·0	18	4	
IV.		Bury St. Edmunds (Westley)	·28	— 1·26	·04	22*a*	10	59·5	9	25·0	18	6	
,,		Norwich (Brundall)	·34	— 1·18	·10	21	8	58·6	9	24·8	17	6	1
V.		Winterborne Steepleton	1·78	...	·56	27	14	52·0	12	23·0	18	3	
,,		Torquay	2·61	...	·63	27	14	57·1	9	34·6	2	0	
VI.		Polapit Tamar [Launceston]..	2·60	— ·01	·62	26	17	58·8	19	26·1	14	3	
,,		Stroud (Upfield)	1·47	— ·45	·39	24	12	55·0	9*b*	28·0	17	4	
,,		Church Stretton (Woolstaston)	2·19	+ ·19	·95	23	13	54·5	9	30·0	2	3	
,,		Worcester (Diglis Lock)	1·92	+ ·41	·56	24	13	...	...	...	...	...	
VII.		Boston	·47	— ·88	·16	24	5	58·0	8	26·0	18	...	
,,		Hesley Hall [Tickhill].....	·98	— ·47	·20	22	11	59·0	8, 19	29·0	18*f*	3	
,,		Derby (Midland Railway).....	1·15	— ·30	·34	24	10	60·0	9	28·0	18	5	
VIII.		Bolton (The Park).....	3·85	+ 1·41	·88	21	22	53·5	20	31·2	2	2	
IX.		Wetherby (Ribston Hall) ...	2·20	+ ·76	·65	21	13	...	...	...	...	...	
,,		Skipton (Arncliffe)	9·15	+ 4·33	1·64	21	21	...	...	...	...	...	
,,		Hull (Pearson Park).	·97	— ·75	·26	21	10	60·0	8	30·0	2	5	1
X.		Newcastle (Town Moor)	1·26	— ·21	·32	26	13	...	...	...	...	...	
,,		Borrowdale (Seathwaite).....	20·85	+ 9·08	3·47	4	24	52·5	8	30·3	28	3	
XI.	WALES.	Cardiff (Ely).....	2·51	— ·38	·53	25	22	...	...	...	...	...	
,,		Haverfordwest	3·09	— ·25	·62	24	19	53·7	19	32·5	13	0	1
,,		Aberystwith (Gogerddan) ...	3·52	+ ·37	·65	25	17	55·0	19*c*	22·0	17	7	
,,		Llandudno.....	3·43	+ 1·48	·74	21	18	57·0	20	34·8	28	0	
XII.	SCOTLAND.	Cargen [Dumfries]	5·70	+ 2·04	1·18	24	18	53·0	8*d*	29·0	28	1	
XIII.		Edinburgh (Royal Observatory)	3·99	...	1·43	8	16	54·5	19	31·3	2	4	1
XIV.		Colmonell	3·35	— ·06	·80	26	18	56·0	19	32·0	27	1	
XV.		Tighnabruaich	8·41	...	1·96	7	21	49·0	9	29·0	1	5	
,,		Mull (Quinish).....	7·92	+ 3·53	1·11	25	27	...	...	...	...	...	
XVI.		Loch Leven Sluices	6·96	+ 4·18	1·96	9	17	...	...	...	...	...	
,,		Dundee (Eastern Necropolis)	3·30	+ 1·17	1·30	8	16	55·3	19	29·3	13	4	
XVII.		Braemar	6·74	+ 4·16	1·45	24	19	52·7	19	28·2	28	9	1
,,		Aberdeen (Cranford)	2·47	+ ·06	1·15	8	17	57·0	19	30·0	12*g*	9	
,,		Cawdor (Budgate)	3·47	+ 1·53	·63	8, 25	19	...	...	...	...	...	
XVIII.		Strathconan [Beauly]	7·05	+ 2·86	1·25	28	14	...	...	...	...	...	
,,		Glencarron Lodge.....	13·54	+ 6·22	1·41	3	27	54·7	20	29·5	28	9	
XIX.		Dunrobin	3·08	+ ·66	·90	8	16	55·0	10	31·0	24	...	
,,		S. Ronaldshay (Roeberry) ...	3·14	+ ·58	·42	25	23	53·0	19	28·0	1	7	
XX.	IRELAND.	Darrynane Abbey.....	3·31	— ·71	·60	26	22	...	...	...	...	...	
,,		Waterford (Brook Lodge) ...	2·75	— ·16	·52	26	14	54·5	9	30·0	28	2	
,,		Broadford (Hurdlestown) ...	2·71	+ ·49	·54	21	20	54·0	9*e*	30·0	1	4	
XXI.		Carlow (Browne's Hill)	3·03	+ ·48	·55	26	15	...	...	...	...	...	
,,		Dublin (Fitz William Square)	2·23	+ ·28	·64	26	15	59·0	8	31·7	28	1	
XXII.		Ballinasloe	4·21	+ 1·78	·51	26	18	55·0	8, 9	26·0	27	10	
,,		Clifden (Kylemore)	7·21	+ 1·30	1·12	27	22	...	...	...	...	...	
XXIII.		Seaforde.....	3·15	+ ·36	·77	26	20	55·0	8, 22	25·0	27	6	
,,		Londonderry (Creggan Res.).	3·93	+ 1·22	·68	26	19	...	...	...	...	...	
,,		Omagh (Edenfel)	4·00	+ 1·40	·65	7	19	57·0	19	28·0	27	4	

+ Shows that the fall was above the average ; — that it was below it.

and 24, 25, 26. *b* and 19, 20. *c* and 20. *d* and 9, 10. *e* and 10, 19. *f* and 28. *g* and 15, 23, 26, 2

SUPPLEMENTARY RAINFALL, FEBRUARY, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	·75	XI.	Llandefaelog-fach.....	3·59
II.	Dorking, Abinger Hall .	2·18	,,	New Radnor, Ednol.....	4·27
,,	Sheppey, Leysdown	1·26	,,	Rhayader, Nantgwillt...	5·82
,,	Hailsham	1·50	,,	Lake Vyrnwy	5·51
,,	Crowborough.....	2·02	,,	Ruthin, Plâs Drâw	2·60
,,	Ryde, Beldornie Tower..	1·42	,,	Criccieth, Talarvor	1·95
,,	Bournemouth, Kempsey	1·95	,,	I. of Anglesey, Lligwy..	4·40
,,	Emsworth, Redlands ...	1·57	,,	Douglas, Woodville.....	3·06
,,	Alton, Ashdell	2·34	XII.	Stoneykirk, Ardwell Ho.	2·17
,,	Newbury, Welford Park	1·77	,,	Dalry, Old Garroch	10·24
III.	Oxford, Magdalen Coll..	·75	,,	Monlaive, Maxwelton Ho.	6·44
,,	Banbury, Bloxham	1·15	,,	Lilliesleaf, Riddell	3·79
,,	Pitsford, Sedgebrook ...	·96	XIII.	N. Esk Res. [Penicuick]	6·25
,,	Huntingdon, Brampton.	·75	XIV.	Dalry, Blair	6·59
,,	Wisbech, Bank House...	·66	,,	Glasgow, Queen's Park..	7·27
IV.	Southend	1·12	XV.	Inveraray, Newtown ...	11·17
,,	Colchester, Lexden	·45	,,	Ballachulish, Ardsheal...	12·89
,,	Saffron Waldon, Newport	·68	,,	Campbeltown, Redknowe	3·64
,,	Rendlesham Hall	·26	,,	Islay, Eallabus.....	5·57
,,	Swaffham	·44	XVI.	Dollar.....	3·38
V.	Salisbury, Alderbury ...	1·60	,,	Balquhidder, Stronvar...	15·13
,,	Bishop's Cannings	1·93	,,	Coupar Angus Station...	3·69
,,	Ashburton, Druid House	4·38	,,	Blair Atholl	5·91
,,	Okehampton, Oaklands.	4·43	,,	Montrose, Sunnyside ...	2·93
,,	Hartland Abbey	2·32	XVII.	Alford, Lynturk Manse..	3·06
,,	Lynmouth, Rock House	3·12	,,	Keith H.R.S.....	2·45
,,	Probus, Lamellyn	1·82	XVIII.	Fearn, Lower Pitkerrie..	1·97
,,	Wellington, The Avenue	1·96	,,	S. Uist, Askernish	5·01
,,	North Cadbury Rectory	1·53	,,	Invergarry.....	16·88
VI.	Clifton, Pembroke Road	2·01	,,	Aviemore, Alvie Manse.	4·20
,,	Ross, The Graig	2·15	,,	Loch Ness, Drumnadrochit	6·59
,,	Shifnal, Hatton Grange	1·27	XIX.	Invershin	3·94
,,	Wem, Clive Vicarage ...	1·41	,,	Bettyhill	4·45
,,	Cheadle, The Heath Ho.	1·17	,,	Watten H.R.S.....	2·21
,,	Coventry, Kingswood ...	1·21	XX.	Cork, Wellesley Terrace	3·37
VII.	Market Overton	·97	,,	Killarney, District Asyl.	5·17
,,	Grantham, Stainby	·97	,,	Glenam [Clonmel]	3·89
,,	Horncastle, Bucknall ...	·47	,,	Ballingarry, Hazelfort...	3·35
,,	Worksop, Hodsck Priory	·95	,,	Miltown Malbay	5·17
VIII.	Neston, Hinderton	1·45	XXI.	Gorey, Courtown House	2·38
,,	Southport, Hesketh Park	2·18	,,	Moynalty, Westland ...	4·19
,,	Chatburn, Middlewood.	5·23	,,	Athlone, Twyford	3·42
,,	Duddon Val., Seathwaite Vic.	8·41	,,	Mullingar, Belvedere ...	4·45
IX.	Langsett Moor, Up. Midhope	4·97	XXII.	Woodlawn	4·58
,,	Baldersby	1·82	,,	Westport, Murrisk Abbey	6·10
,,	Scalby, Silverdale	1·73	,,	Crossmolina, Enniscoe ..	6·36
,,	Ingleby Greenhow Vic..	1·83	,,	Collooney, Markree Obs.	5·19
,,	Middleton, Mickleton ...	3·93	XXIII.	Enniskillen, Portora ...	3·74
X.	Beltingham	4·98	,,	Warrenpoint.....	3·17
,,	Bamburgh	1·40	,,	Banbridge, Milltown ...	1·84
,,	Keswick, The Bank.....	9·45	,,	Belfast, Springfield	3·02
,,	Melmerby Rectory	4·21	,,	Bushmills, Dundarave..	3·11
XI.	Llanfrechfa Grange	2·84	,,	Stewartstown	1·75
,,	Treherbert, Tyn-y-waun	7·11	,,	Killybegs	6·09
,,	Castle Malgwyn	4·10	,,	Horn Head	5·29

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPTEMBER, 1902.

STATIONS. /Those in italics are South of the Equator./	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	76·0	22	38·3	19	67·0	48·7	50·8	80	121·3	35·2	1·00	9	5·7
Malta	91·6	4	63·2	...	84·1	70·6	67·2	75	141·0	58·9	2·58	4	2·8
Cape Town	72·0	19	44·2	26	64·1	52·2	49·7	75	...	...	5·98	16	5·7
Durban, Natal	105·6	23	51·5	3	77·3	57·9	...	...	156·1	...	2·54	13	6·0
Mauritius	81·8	19	55·4	16	79·5	63·4	61·0	71	146·5	46·1	1·25	15	5·0
Calcutta	92·2	4	75·2	30	89·5	78·9	77·7	83	158·8	71·4	6·98	12	7·8
Bombay	87·1	12	73·3	17	84·6	76·9	76·0	86	137·5	69·7	27·11	21	6·9
Madras	98·7	3	72·1	18	92·3	76·9	74·5	79	151·3	70·7	4·65	16	6·1
Kodaikanal	67·2	4	51·1	7	64·0	52·8	51·8	82	141·9	42·3	3·07	16	7·2
Colombo, Ceylon	90·0	28	72·0	4	86·8	75·4	74·2	83	150·0	71·0	8·18	20	6·9
Hongkong	91·2	22	69·6	28	87·3	76·2	68·3	65	146·5	...	·64	6	4·0
Melbourne	80·0	25	35·0	17	62·1	44·8	44·2	72	138·9	27·1	3·30	10	6·4
Adelaide	86·5	30	38·8	14	68·1	48·5	46·0	64	139·7	32·6	1·64	16	5·3
Coolgardie	83·6	4	38·0	13	71·5	48·3	45·6	60	152·2	33·0	1·02	6	3·2
Sydney	78·1	7	44·4	13	65·9	52·2	48·2	70	118·0	33·7	2·10	16	4·1
Wellington	60·0	2, 6	34·0	23*a*	54·7	42·1	39·6	73	112·0	26·0	3·11	21	6·9
Auckland	63·5	19	41·0	10	56·9	45·4	41·1	69	128·0	38·0	6·21	22	5·2
Jamaica, Negril Point	89·8	16	69·8	24	88·1	73·2	73·6	78	...	...	7·14	18	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	88·8	13	72·2	1	85·1	75·0	68·7	57	158·2	...	7·08	23	2·0
Toronto	79·0	23	38·0	15	68·9	51·8	54·7	82	101·2	31·9	3·35	14	6·3
Fredericton, N.B.	79·3	2	31·0	26	68·3	46·8	47·9	67	...	...	3·83	9	5·2
Winnipeg	80·0	7	28·0	12	65·0	40·6	...	...	...	...	2·01	9	5·3
Victoria, B.C.	79·0	11	38·7	28	63·9	49·1	48·3	75	...	...	2·31	8	4·0
Dawson	62·0	8	26·4	28	50·4	35·5	...	...	...	...	1·17	9	5·5

a—and 24.

MALTA.—Mean temp. of air 76°·1, or 1°·0, above average. Mean hourly velocity of wind 6·5 miles or 1·2 below average. Mean temp. of sea 76°·7. T88 on 6 days, L on 3 days, H on 28th. J. F. DOBSON.

Mauritius.—Mean temp. of air 1°·1, dew point 1°·0 above; rainfall ·13 in. and mean hourly velocity of wind 1·1 mile below their averages. T. F. CLAXTON.

MADRAS.—Temp. below normal generally. L on 11 days, T on 9 days, and a T8 on one day. Sunshine 113·6 hours, or 31·2 per cent. of possible. A. MOFFAT.

KODAIKANAL.—Bright sunshine 106 hours. A very cloudy month. C. MICHIE SMITH.

COLOMBO.—Mean temp. of air 80°·9, or 0°·1 above, of dew point 1°·0 above, and R 2·24 in. above, their respective averages. Mean hourly velocity of wind 8·3 miles, prevailing direction, S.W. T88 on 3 days. H. O. BARNARD.

HONGKONG.—Mean temp. 80°·8. Sunshine 225 hours, or 25 hours above average. R 12·01 in. below average. Mean hourly velocity of wind 8·0 miles. F. G. FIGG.

Adelaide.—Mean temp. 58°·3 or 1°·2 above, and R ·08 in. below, average. C. TODD.

Sydney.—Mean temp. 0°·2 above, humidity 0°·4 below, and R ·88 in. below averages. H. C. RUSSELL, F.R.S.

Wellington.—Mean temp. 2°·5 below, and R 1·15 in. below, averages. A. H. GORE.

Auckland.—Mean temp. 3°·5 below average, R nearly 3 in. above the average. Unusually wet and stormy. T. F. CHEESEMAN.

SYMONS'S

METEOROLOGICAL MAGAZINE.

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THE RAINFALL OF THE WINTER MONTHS.

THE year may be conveniently divided for some rainfall purposes into a winter and a summer half, and the winter half-year just concluded presents some special features as a whole, and in its several parts, to which reference must be made.

March has proved a wet month at all stations in the British Isles, except a very few on the east coast. It will be noticed in our table on p. 56 that only Newcastle, Aberdeen, Dunrobin, and Roeberry, in Orkney, show readings below the average March fall for the ten years 1890-99. In some cases twice the average fall was experienced, and in most there was an excess of from a half to two-thirds. At Seathwaite, and several other stations in the Lake District, and at some stations in Scotland, rain was reported on every day of the month. While a considerable part of the east of England had less than two inches of rain, the whole of Ireland (except a little patch round Dublin) had more than four inches, and a large area in the west Highlands of Scotland, had a rainfall exceeding 12 inches, and in some places reaching 20 inches. In the Lake District the gauge at The Stye collected 30·3 inches of rain. The distribution of rainfall was similar to that of February, though the contrast between the south-east and north-west was not nearly so great. The prevalence of S.W. and W. winds continued, due to the same cause, the passing of a procession of cyclonic disturbances towards the N.E. off our west coasts.

Table I. gives for 25 representative stations the rainfall in inches for each of the three months of 1903, and the total for three months, followed by the difference in inches from the ten years' average for each month and for the three months.

The values range from 3¾ inches for Brundall near Norwich, where the fall fell short of the average by one-quarter, to no less than 61¼ inches for Seathwaite in Borrowdale, where the fall exceeded the average by nearly two-thirds. At two of the Scottish stations it will be noticed each of the three months had more than ten inches of rain, an unusual circumstance even in the wetter parts of the Highlands.

TABLE I.—*Rainfall of the First Three Months of* 1903.

STATIONS.	RAINFALL.				DIFF. FROM AVERAGE.			
	Jan.	Feb.	Mar.	Total.	Jan.	Feb.	Mar.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.
London	2·15	·83	2·30	5·28	+ ·44	— ·64	+ ·84	+ ·64
Hitchin	2·52	1·03	3·22	6·77	+ ·81	— ·43	+ 1·78	+ 2·16
Westley	1·90	·28	2·12	4·30	+ ·21	—1·26	+ ·49	— ·56
Brundall	1·68	·34	1·73	3·75	+ ·01	—1·18	+ ·12	— 1·05
Ashburton	6·83	4·38	8·72	19·93	+1·39	+ ·01	+ 5·13	+ 6·53
Polapit Tamar	5·14	2·60	5·86	13·60	+1·81	— ·01	+ 3·58	+ 5·38
Woolstaston	2·74	2·19	4·81	9·74	+ ·28	+ ·19	+ 3·04	+ 3·51
Wetherby	2·21	2·20	3·50	7·91	+ ·55	+ ·76	+ 1·87	+ 3·18
Arncliffe	9·81	9·15	10·69	29·65	+3·43	+4·33	+ 5·57	+13·33
Seathwaite	18·18	20·85	22·23	61·26	+3·33	+9·08	+11·57	+23·98
Cardiff	5·65	2·51	5·75	13·91	+2·09	— ·38	+ 3·19	+ 4·90
Haverfordwest	6·11	3·09	6·44	15·64	+1·49	— ·25	+ 3·70	+ 4·94
Gogerddan	5·38	3·52	6·02	14·92	+1·13	+ ·37	+ 3·18	+ 4·68
Dumfries	6·24	5·70	10·15	22·09	+1·66	+2·04	+ 7·10	+10·80
Lilliesleaf	5·47	3·79	5·03	14·29	+3·12	+1·67	+ 2·79	+ 7·58
Glasgow	7·16	7·27	7·96	22·39	+3·72	+4·47	+ 5·48	+13·67
Inveraray	10·60	11·17	11·20	32·97	+2·51	+5·29	+ 5·36	+13·16
Loch Leven	7·20	6·96	6·56	20·72	+3·90	+4·18	+ 3·98	+12·06
Braemar	4·57	6·74	6·96	18·27	+1·79	+4·16	+ 4·64	+10·59
Aberdeen	4·98	2·47	1·92	9·37	+2·26	+ ·06	— ·28	+ 2·04
Glencarron	14·01	13·54	11·45	39·00	+3·62	+6·22	+ 4·51	+14·35
Waterford	6·04	2·75	5·95	14·74	+2·52	— ·16	+ 3·43	+ 5·79
Carlow	4·85	3·03	5·98	13·86	+1·78	+ ·48	+ 3·77	+ 6·03
Mullingar	6·45	4·45	6·16	17·06	+3·48	+1·80	+ 3·72	+ 9·00
Omagh	6·19	4·00	7·03	17·22	+2·68	+1·40	+ 4·45	+ 8·53

TABLE II.—*Six Months' Winter Rainfall, October,* 1902—*March,* 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Station.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	—1·33	88	Arncliffe +	10·19	129	Braemar +	11·56	163
Tenterden	— ·95	93	Hull	— ·53	96	Aberdeen	+ ·03	100
Hartley Wintney	+1·23	110	Newcastle	—1·07	92	Cawdor	+3·04	121
Hitchin	— ·22	98	Seathwaite +	16·58	121	Glencarron +	10·88	120
Winslow	—1·03	91	Cardiff	+4·62	121	Dunrobin	—2·01	89
Westley	—3·51	71	Haverfordwest	+5·32	121	Darrynane	+ ·61	102
Brundall	—3·83	68	Gogerddan	+2·69	111	Waterford	+7·06	135
Alderbury	+1·29	109	Llandudno	+2·73	116	Broadford	+4·87	128
Ashburton	+5·16	117	Dumfries +	10·78	143	Carlow	+6·44	136
Polapit Tamar	+6·41	132	Lilliesleaf	+6·95	144	Dublin	+3·23	123
Stroud	+1·76	113	Colmonell	+4·54	118	Mullingar	+7·71	143
Woolstaston	+2·58	117	Glasgow +	12·02	161	Ballinasloe	+6·14	133
Boston	— ·17	98	Inveraray	+8·97	121	Clifden	+4·32	110
Hesley Hall	+ ·33	103	Islay	+3·05	111	Crossmolina	+7·81	125
Derby	+1·58	115	Mull	+6·31	119	Seaforde	+6·51	134
Bolton	+2·46	112	Loch Leven	+9·88	151	Londonderry	+2·38	111
Wetherby	+4·04	135	Dundee	+1·83	112	Omagh	+7·40	137

Turning now to the six months' winter rainfall as a whole, Table II. shows the condition of the country.

It will be seen that, except along the east coast, where Norfolk and Suffolk have received little more than two-thirds of their usual supply, the country has been well watered. In Ireland the winter rainfall shows on the average an excess of one-third, the centre of Scotland has the very unusual excess of one-half, while in Wales and the west of England, the excess averages one-fifth. The winter months have thus been wet not only relatively to the recent run of dry years, but relatively to the normal rainfall of a very long period. The consequences may be unpleasant for the farmer, but they will ensure a water-supply which will relieve the water-works engineer from anxiety as to the possible dryness of the summer half-year.

THE TEMPERATURE OF MARCH, 1903.

It would probably be difficult to find any month in any year which was not in some way unique with regard to its weather, so distinct is the individuality which the grouping of the multitudinous conditions of climate can confer. But it is not often that the month of March pushes itself so far in advance of the season as it has done this year, at least in the south of England. In the north of England, in Scotland and in Ireland, the excessive rainfall has drowned all other considerations, but everywhere in the British Isles March has been unduly mild.

The average values for the daily mean, 9 a.m., 9 p.m., maximum and minimum thermometer readings for the whole month of March at Camden Square were as follows for the average of 40 years, 1858-95, for 1903, and for the occasion of highest value previously recorded.

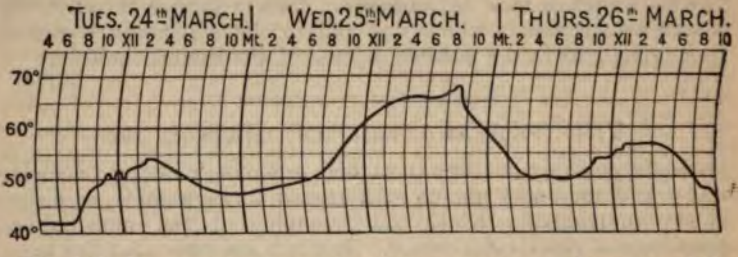
	Average Mean.	9 a.m.	9 p.m.	Max.	Min.
Average March	42·1	41·8	41·3	50·2	35·5
March, 1903	**46·4**	**46·1**	**46·0**	**53·9**	**39·5**
Difference	+4·3	+4·3	+4·7	+3·7	+4·0
Highest previous ...	46·3	46·7	45·7	56·6	39·9
Year	1859	1859	1896	1893	1859&'96

It will be noticed that March, 1859, was very nearly as warm on the average as March, 1903.

The main feature of the temperature of the month was the warmth of one day, the 25th. The mean temperature of that day at Camden Square was 58°·3, the warmest March day recorded previously (March 24th, 1858) having had a mean of 56°·0. The maximum temperature on a Glaisher stand was 67°·9, which has been exceeded in three years out of the last forty-six, viz.: March 16th, 1884 (68°·0), March 24th and 26th, 1871 (68°·4 and 68°·7), and March 24th, 1858 (70°·1). The unprecedented nature of the day was due to the fact that the maximum temperature was not reached until nearly two hours after sunset, and the 9 p.m. reading

was 64°·2, the highest ever previously recorded at that hour having been 57°·2 on March 22nd, 1896.

Mr. F. Campbell Bayard has kindly sent us the trace of his thermograph at Wallington, near Croydon, which is reproduced in order to show the peculiar nature of the day. After the normal maximum about 4 p.m. the temperature fell slightly until 6 p.m., and then rose steadily until about 8.30 p.m., when an abrupt fall occurred. Mr. G. von U. Searle informs us that his thermograph at West Kensington showed a maximum of 68°·3 at 8 p.m. precisely.



The fall of temperature was simultaneous with a sudden rise of the barometer resembling the first half of a typical thunderstorm curve. A slight thunderstorm was noted in London, but it seems to have been more severe to the south west. Lady Jenkyns, of Botley Hill, Botley, writes:—

"The 25th was our one warm day at Botley. From 1 p.m. till 5 p.m. the distant thunder was almost continuous, and so unlike thunder sometimes that people said it must be the sound of guns; but guns would not have gone on so long. As it grew dark there was a good deal of lightning, some forked, but that never came nearer. All this was to the south-west of us, towards Southampton; perhaps it was in the Isle of Wight or at sea."

Colonel Ward, writing from Upton Park, Slough, says:—

"On the 25th the temperature went up to 67° at 2 p.m., and at 4 it was 65°, where it remained until a heavy thunderstorm passed over from the south-west about 7 p.m. Between 9 and 10 a.m. very distant thunder was heard almost continuously in the south-west and south. At 2 p.m. heavy clouds came up from the south-west, and at 5 p.m. they were real 'pocky clouds' such as one sees in the north of Scotland, and which my old friend Clement Ley called mammato-cumulus. The day reminded me of one in the sixties or late fifties in Wiltshire, when we heard what we then thought was thunder, but it turned out to be the French and British fleets saluting at Cherbourg."

Several observers comment on the remarkably low relative humidity of the day, the depression of the wet-bulb exceeding 11° at 9 p.m.

At Greenwich Observatory the mean temperature was 58°·2, or 15°·8 above the normal mean temperature of March 25th as shown by a record of fifty years.

THE SHORTAGE OF WATER.

A CONFERENCE on the present shortage of water available for supply was held in the Parkes Museum, Margaret Street, London, under the auspices of the Sanitary Institute, on Wednesday, February 11th, Sir A. R. Binnie, C.E., in the chair. Mr. W. Whitaker, F.R.S., opened the conference by showing that in all parts of England the level of underground water had been sinking in recent years, in some cases at an alarming rate. This he attributed in part to a diminution of the rainfall, which, he suggested, might possibly be of the nature of a progressive change, though on this point he would not express a decided opinion. In part it was undoubtedly due to the excessive pumping of water from the permeable water-bearing strata, sometimes for the purpose of manufactures or water-supply; but frequently, as in the case of the Severn tunnel, and of many mines and quarries, simply to clear the workings, the water pumped being absolutely wasted. Mr. Whitaker urged the importance of legislation as to property in underground water.

Mr. J. Hopkinson followed with explicit details as to the very remarkable diminution in the supply of water from the deep wells in Hertfordshire, where the dearth of water was becoming a serious matter, especially in the valley of the Lea.

Dr. H. R. Mill pointed out that rainfall statistics did not bear out the theory of a secular diminution of rainfall. Taking the average rainfall of the British Isles as a whole, he showed that out of the 37 years, 1865-1901 (regarding which data were available in "British Rainfall") the seven years, 1865-71, had on the average the same annual fall as the whole period, the 15 years, 1872-86, had an average excess of eight per cent., and the 15 years, 1887-1901, had an average deficiency of eight per cent. During the last 15 years the rainfall of the country as a whole had only been above the average on three years. The deficiency was scarcely noticeable in Ireland, or Wales; in the West of Scotland, the English Lake District and the north-west of Yorkshire, there had been an actual excess, but the deficiency in the central parts of England had been very great, reaching 16 or 17 per cent. for the ten years, 1890-99. We were at present in a dry period, but it was impossible to say whether we were near the end of it or not.

Mr. Baldwin Latham pointed out a number of historical occasions when the dearth of water in particular areas was much greater than at present, and he made special reference to the conditions determining the evaporation and percolation of rain-water on the ground. He believed the average rainfall would ultimately be re-established.

Mr. Verney, of the London County Council, said it was the duty of the citizens of London to secure such a water supply that no period of local drought, however prolonged, would lead to the risk of a water famine.

Mr. Clayton Beadle gave particulars of the drying-up of streams and the sinking of the water-level in the chalk in the north of Kent, where the inhabitants were becoming seriously alarmed.

Mr. Douglas Archibald said that the statistics of rainfall appeared to him to leave little room for any theory of secular change; but on the contrary, they showed evidence of periodical variations agreeing in so striking a way with Brückner's 35½-year cycle that, without making a prediction, he would not be surprised if the present dry period were to terminate in the year 1905 or 1906.

Sir Alexander Binnie briefly summed up the discussion, and thanked Mr. Whitaker for his opening paper. A vote of thanks to the Chairman terminated the meeting.

James Glaisher, F.R.S.

1809–1902.

THE death of so distinguished a meteorologist as the late James Glaisher, requires more than a mere record of the fact in the pages of any English magazine devoted to meteorology.

Mr. Glaisher was born so long ago as the year 1809, and at the time of his death he was within a couple of months of completing his 94th year. His early life was spent not far from the Royal Observatory, and his determination to follow a scientific career was, probably, largely due to an intimate friendship he formed in those days with a member of the Observatory staff. At the age of twenty Glaisher obtained an appointment upon the trigonometrical survey of Ireland, and for about three years he remained in that country, occupied for the most part in field work. He then became assistant to Professor G. B. Airy, who was at that time the Director of the Observatory at Cambridge. Subsequently, when Airy became Astronomer Royal, Glaisher was offered a post on the Greenwich staff, of which he continued to be a member from the year 1835 until his retirement in 1874.

Glaisher's early work, both at Cambridge and at Greenwich, was wholly astronomical, and it was not until, in the course of re organization of the Observatory, the Magnetical and Meteorological Department was established that he entered upon the study of the science in which he made his mark. When this new department was established Airy placed it under Glaisher's superintendence, and probably a better choice for the post could hardly have been made. He lost no time in getting to work, not only upon organization, and observational details, but also in carrying out various investigations which presented themselves in his new field of research.

One of the earliest of these was an enquiry into "the amount of heat radiated at night from the surface of the earth," published in the *Philosophical Transactions* for 1847; and this was followed by his tables of correction for diurnal range, which appeared in the next volume of the same publication. About the same time, too, he was busy upon the production of the Hygrometrical Tables, which are so familiar, and so useful, to every meteorologist, and without which determinations of the dew-point, the humidity of the air, and its

elastic force, would be a far more difficult and intricate business than it now is; the fifth edition of these tables was issued in 1869.

The year 1849 was an important one to Glaisher because he then became a Fellow of the Royal Society, and also because it was in that year that he began to furnish to the Reports of the Registrar General, the quarterly meteorological returns for England, which have regularly appeared there ever since, and which Mr. Glaisher himself continued to supply until last year. This was the first attempt ever made to organize a body of volunteer meteorological observers for such co-operative work, and in it we have the germ of the system which became so largely developed under the late Mr. Symons, in the British Rainfall Organization, and which has also been adopted and extended by the Meteorological Office, and by the Meteorological Societies, in their corps of climatological observers.

In the year 1850 the Meteorological Society was founded by Dr. Lee and others, of whom Glaisher was one, and Glaisher becoming its first Secretary, and seventeen years later its tenth President. The prominent part he took in the early development of the society is generously acknowledged in the following words, written by the late Mr. Symons in anticipation of the Jubilee of the society, held three years ago,—words which, alas! had to be spoken by another—"during the first half of its career the society was largely guided by its original secretary, and our oldest Fellow, Mr. James Glaisher, F.R.S., who nursed it through its infancy and youth, and left it to other hands only when it was old enough and strong enough to walk alone." By the death of Mr. Glaisher the last of the ten men who first constituted the Meteorological Society has passed away.

But the work which most of all drew public attention to Mr. Glaisher was that done by him, at the instigation of the British Association, in exploring the upper regions of the atmosphere by means of balloons. This work was spread over a period of five years, and embraced about 30 ascents, the most remarkable of which was also one of the earliest, and was made from Wolverhampton on September 5th, 1862, when a height estimated at about 7 miles was reached, and both Glaisher and his aeronaut, Coxwell, narrowly escaped losing their lives. Subsequently these "free" ascents were supplemented by others, made with a large "captive" balloon at Chelsea.

Thenceforward the subject of aërostation occupied a great deal of Mr. Glaisher's attention. He wrote the article on Aëronautics (23 pp.) in the ninth edition of the *Encyclopædia Britannica*, and besides many smaller contributions to various magazines, he edited English translations of works on the subject by the French writers, M.M. Tissandier and Flammarion.

Space will not allow us to name the subjects dealt with in the 52 works with which he is credited in the Royal Society's catalogue of scientific papers, the latest of which was on the "variation of temperature with altitude in the neighbourhood of the ground" and

appeared in the *Comptes Rendus* of the Paris Academy of Sciences, and in *Nature*, in 1877; but the subjects covered a great deal of ground, chiefly on the statistical and climatological side of meteorology.

Strong both physically and mentally, Mr. Glaisher's was an active life throughout, and he was ever a keen controversialist. Up to the end he maintained his interest in the several learned societies to which he belonged, besides continuing to take an active part in the directorate of more than one public company.

He died on February 7th, 1903, and was buried at Shirley, near Croydon. R.H.C.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on March 18th, at the Institution of Civil Engineers, Great George Street, Westminster, Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

The following gentlemen were elected Fellows:—Mr. A. E. Abbott, M. L. Teisserenc de Bort, Mr. B. P. Evans and Mr. A. F. Waterhouse.

This was the "popular" meeting of the session, and was very numerously attended by the Fellows and their friends. Mr. C. V. Boys, F.R.S., at the request of the Council, gave a lecture on "The Transmission of Sound through the Atmosphere," which he illustrated by experiments and lantern slides.

The lecturer began by stating that his object was not to give examples of observations of the anomalous manner in which sound sometimes either passes to great distances or fails to pass to moderate distances, but to give some account of the physical causes of such anomalous behaviour. Sound is transmitted as a compression and rarefaction wave in the air. Mr. Boys contrasted the apparent differences in the behaviour of waves of water, sound waves, and light waves, and showed that these were merely an effect of the relative wave lengths and the means of observation. He pointed out the perfection of the behaviour of ripples as compared with larger water waves in obeying the laws of reflection and refraction, and exhibited some beautiful illustrative slides.

Experiments with sound waves of a similar kind require apparatus on the scale of magnitude of houses or hills, unless sound waves too short to be audible are employed. By the aid of a sensitive flame the lecturer showed the absolute obedience to the ordinary laws of radiation of sound waves too short to produce audible effects.

When a sound wave is passing through the air there is an alternate condensation and rarefaction. Even though this may be very small, the variation amounting generally to far less than $\frac{1}{1000}$ of the whole pressure, the air, so compressed, or rarefied, is, to an almost infinitesimal extent, more slowly or more quickly traversable by light, *i.e.*, it is almost infinitesimally more or less refractive to light. This opens up the possibility of seeing and photographing a sound wave. Mr. Boys exhibited photographs of rifle bullets travelling at a speed greater

than that of sound. In such cases there is no time for the air to pass round and get to the other side of the bullet. It is compressed in front, so that a wave like a ship's wave is produced, the limbs travelling outwards with the velocity of sound, while the highly compressed wave in front travels twice or perhaps three times as fast, according to the speed of the bullet By means of the animatograph representations were given of Mr. Ryves' observation of the shadow of the sound of a great explosion, and also of Prof. R. W. Wood's photographs of sound waves.

He concluded by referring to mirage and looming in optics, and stated that the corresponding phenomena in acoustics give rise to abnormal audibility of sound.

On the motion of the chairman a hearty vote of thanks was accorded to Mr. Boys.

IRISH BAROGRAMS OF THE STORM OF FEBRUARY 26TH.

By PROFESSOR C. J. JOLY, *Royal Astronomer for Ireland.*

I HAVE examined about one hundred barograms obtained during the week of the recent storm, culminating on the night of February 26th–27th, which were kindly sent to me from many parts of Ireland, nearly every county being represented. Assuming that the trough of the depression was a straight line and that it moved with uniform velocity across the country, I combined the records so as to get rid of uncertainty in the time as much as possible, and the results of my calculations showed that the trough travelled at the rate of about 47 miles an hour from the south-west, or more exactly from a point 50½ degrees west of south. The data at my disposal hardly warrant any more definite conclusion on account of the uncertainty in the time. This uncertainty is partly due to carelessness in setting the instrument and in taking account of the error in the clock driving the drum, and partly owing to defects in the barograph sheets. I feel sure, from cases that have come under my own observation, that owners of barographs do not always insist on being supplied with sheets made specially for their type of instrument. From this cause an error of an hour or more may occur in parts of the curve. Moreover some sheets appear to be most carelessly manufactured. This may be seen by partially superposing two sheets of the same make so that on looking through them in a strong light the time lines of the first part of the week on one sheet may cover as nearly as possible the time lines of the second part of the week on the other sheet. With well-made sheets the coincidence should be exact, but I have seen sheets in which there is a divergence of nearly half an hour.

In the same way I investigated the depth of the depression, from a well-marked summit immediately preceding the storm, to the lowest point of the curve. I assumed, in the first place, that the curves of equal depression across the country were straight lines, and

that the depression increased uniformly at right angles to these lines. The results showed that this assumption was not strictly accurate though it appears to be a very fair approximation. These lines of equal depression make an angle of about 11 degrees with the line of advance of the trough; in fact, looking along one of these lines towards the east, the direction is about 28½° north of east. I drew these lines for depressions of ·9 in., 1·0 in., 1·1 in., 1·2 in., 1·3 in. and 1·4 in., the distance between neighbouring lines representing about 31 miles, and the means of the observed depressions adjacent to the lines I found to be respectively ·86 in., 1·00 in., 1·12 in., 1·28 in., 1·30 in. and 1.29 in. The divergence is apparent, and the depressions are very large near the fourth line which runs nearly from Galway to Dundalk. The first line runs just south of Cork and Waterford.

Comparison of the shapes of the barograph curves is very interesting but difficult to describe without diagrams. Speaking generally, the first thought on superposition of a shallow and a deep curve is that the latter has simply grown deeper from the former, the upper parts of the curves remaining much the same. There is, however, a multitude of minute characteristics which can be traced from one locality to another, and after a little study it would be quite possible to predict the place from which a curve had been sent. One of the most striking peculiarities consists in the thickening and roughening of the lower parts of the curve caused by vibration of the pen. This seems to indicate rapid alterations in the pressure. It is not much marked on the southern curves with smoothly rounded blunt bends; it becomes very much marked indeed on the sharp curves from the neighbourhood of Dublin and along the line from that place to Ennis, and also on the south east, but curves north of Ennis and of Dublin show hardly a trace of the vibration. They become deeper and the bend consists of a smooth small round curve.

I think it is a pity that more is not done to encourage owners of barographs to keep careful records, for I believe that the barograph would prove to be a most valuable instrument for scientific purposes, if even one-tenth the attention were given to it that the mercurial barometer has received. A thorough discussion of all the available records for a year might lead to very important results, and I hope, even if this laborious task is not undertaken, that some one with more leisure than I have will completely work up the barograms of the recent storm.

[In our last number we gave some particulars of the great damage wrought by the storm, the barograms of which have been collected and discussed in so interesting a manner by Professor Joly. We have now the pleasure of reproducing two striking photographs taken by Mr. Greenwood Pim, of Monkstown, Co. Dublin. They illustrate the fate of many thousand trees in all parts of Ireland; their fall may be viewed as a trace from nature's recording anemometer, the marks of which will not soon be obliterated.—ED. *S.M.M.*]

Photograph by Greenwood Pim, Esq.]
TREES UPROOTED BY THE GALE AT MONKSTOWN, CO. DUBLIN, FEBRUARY 26TH, 1903.

Photograph by Greenwood Pim, Esq.]
TREE UPROOTED BY THE GALE AT GLASNEVIN, BOTANIC GARDENS, FEBRUARY 26TH, 1903.

REVIEWS.

The Meteorology of the Ben Nevis Observatories. Part II, containing the observations for the years 1888, 1889, 1890, 1891 *and* 1892 *with Appendices.* Edited by ALEXANDER BUCHAN, LL.D., F.R.S., and ROBERT TRAIL OMOND. (Forming Vol. 42 of the "Transactions of the Royal Society of Edinburgh.") Edinburgh, 1902. Size $12\frac{1}{2} \times 9\frac{1}{2}$. Pp. xiv. + 552.

THE high-level observatory on Ben Nevis was opened in 1883, and the hourly readings of the various instruments from December 1st, 1883, to December 31st, 1887, were printed in full in vol. 34 of the *Transactions* of the Royal Society of Edinburgh. The present volume contains the hourly readings for the following five years, 1888-92, and also those for the low-level observatory which was founded as one of the five observatories of the Meteorological Council in 1890. The cost of preparing the volume has been shared by the Royal Societies of London and Edinburgh.

The hourly tables present a mass of honest hard work such as has very rarely been put on record before, for since the severe climatic conditions of the summit of Ben Nevis make it impossible to leave ordinary recording instruments in the open air, every reading at every hour, summer and winter, day and night, has been made by direct personal observation. The difficulties of the task are briefly touched upon in the introduction, and for the most part the records show that these have been bravely and successfully met. One difficulty, however, has not been got over, and that is the measurement of wind-force. A Robinson cup-anemometer is used in summer, but on account of the accumulation of ice-crystals deposited from fog it cannot be employed in winter. So far as we are aware a Dines' anemometer which, we believe, could readily be adapted to the conditions of Ben Nevis, has not been tried, and the strength of the winds has to be estimated without instrumental aid; a serious matter, for the velocity on extreme occasions is stated to exceed 150 miles per hour. The importance of obtaining trustworthy anemometric observations at so great a height is one argument for the continuance of the observatory and the extension of its equipment; indeed, without such observations, a great deal of the most valuable part of the work cannot be fully utilized. It is shown very clearly by Dr. Buchan in the appendix that the readings of the barometer require a large correction during gales; the mercury being depressed as much as one-hundredth of an inch by the suction of the wind at 20 miles an hour blowing past the barometer room; while a wind of 80 miles an hour produces a depression of one-tenth of an inch. As a violent gale may be raging at Ben Nevis, while a calm reigns in Fort William, it is plain that the whole value of the barometric observations depends on determining the wind factor. This is, of course, not a local effect, and a similar correction must doubtless be applied to barometers at sea-level read in windy weather, so that the whole

question of the relation of wind-force to barometric gradient is opened up for discussion.

The numerous papers in the appendix show that solid results have already been obtained; but we deplore the absence of diagrams which are really essential to the clear comprehension of any discussion involving time-changes of phenomena. The scientific world is indebted to the Ben Nevis directors for their splendid enterprise, which has been carried out in a way that is an honour, not only to Scotland, but to the British Empire and to the world at large. The work can be extended and improved at the observatories; it can be discussed for scientific purposes with the certainty of success: and it may very well be that thorough discussion of the records will give to the Observatory a permanent place in weather forecasting, though as yet the way in which this may be done has not been discovered. If the whole series of Ben Nevis observations could be discussed by some competent specialist, who would be relieved from all other work until the task was finished, we believe that the result would justify the expense; and could not a temporary chair of meteorology in the University of Edinburgh be instituted for this purpose by the Carnegie Trust?

Temperature Tables for the British Islands. Supplement. Difference Tables for each five years for the extrapolation of mean values. Size 12 × 10. Pp. viii + 36. Price 3s.

Hourly means of the readings obtained from the self-recording instruments at the five observatories under the Meteorological Council. 1899. Size 12 × 10. Pp. xii. + 240. Price 37s. 6d.

Meteorological Observations at Stations of the Second Order, for the year 1899. *With frontispiece Map.* Size 12 × 10. Pp. xiv. + 182. Price 22s. 6d. Published by Direction of the Meteorological Council. London, 1902.

THE occasional delay in noticing new publications, necessitated by the abundance of other matters of interest pressing on our restricted space, has at least the incidental advantage, that we are sometimes able to notice together several works of kindred aim, or similar origin, as in the case of the three publications of the Meteorological Office named above. The volume to which the first named is a supplement (see this magazine for July, 1902, p. 93) gave the mean monthly values for temperature for 117 stations, but not in all cases for the same period of years. The present publication gives the mean monthly values for the same stations grouped in five-year periods, showing the correction to be applied to bring any period to the mean value for 30 years wherever so long a period exists. As the stations are arranged under the Meteorological Office forecasting divisions, it is easy in cases of shorter records to see, by inspecting the values for neighbouring stations, what correction is required to deduce the 30 years mean from the mean of any five years.

The second volume is a record of the hourly values of the various meteorological elements which are registered automatically at the Meteorological Office observatories at Valencia, Fort William, Aberdeen, Falmouth and Kew. It is in all respects similar to the issues for earlier years, and supplies information which for many purposes is of great value. For other purposes, however, the results as published cannot be utilized. It is natural to wish to compare the duration of sunshine with the duration of rainfall; but the tables only offer a comparison of the duration of sunshine with the intensity of rainfall per hour, when any rain happened to fall in a given hour, and as the rainfall "hour" called 2 is that extending from 1 o'clock to 2 o'clock, while the sunshine hour called 2 is that extending from 1.30 to 2.30, the attempt to utilize these tables even for such a purpose is wholly vain.

The third volume is also on the familiar lines and it permits of the comparison of the 9 a.m. and 9 p.m. observations at 80 stations, the geographical positions of which as shown on the map leave large tracts of country in some places unrepresented, while in others two or even three stations are close together. Where, as in the case of Fort William and Ben Nevis, the adjacent stations differ greatly in their elevation, or exposure, their vicinity of course adds much to the interest of the comparison.

We regret to see the disparity between the dates of observation and publication, and we regret still more to see the high prices placed upon reports which can never, by their sale, pay more than a fraction of the cost of production. If the observers—most of them voluntary and unpaid—whose work is here set forth, receive a copy of the publications in return for their observations the high price may be accepted as a delicate compliment; but the delay in publication would deprive the compliment of much of its value, even if the hypothesis put forward could be accepted.

BOOKS RECEIVED.

County Borough of Bolton. Annual Report of the Museums and Meteorological Observatory for 1902. [By W. W. Midgley.] Bolton, 1903. Size 8½ × 5½. Pp. 20 and table.

U.S. Department of Agriculture. Weather Bureau. Bulletin I. Eclipse Meteorology and allied problems. By Frank H. Bigelow, Professor of Meteorology. Washington, 1902. Size 11½ × 9½. Pp. 166.

Meteorological History of the Seven Monsoon Seasons, 1893-1899, in relation to the Indian Rainfall. By W. L. Dallas. Indian Meteorological Memoirs, Vol. XII. Pp. 409–486.

Meteorological Data of the Wirral Peninsula, Liverpool and District and Southport. By the Rev. J. Cairns Mitchell. [From *Liverpool Flora*, 1902.] Size 8½ × 5½. Pp. 12.

United States Magnetic Declination Tables and Isogonic Charts for 1902. By L. A. Bauer. Washington, 1902. Size 11½ × 7½. Pp. 405. *Plates and illustrations.*

Report on the Meteorology of Margate, 1882-1901. By John Stokes. Margate, 1902. Size 9½ × 6. Pp. 8.

METEOROLOGICAL OBSERVATIONS AT CAMDEN SQUARE FOR 40 YEARS, 1858–97.

RAINFALL.—EXTREMES.

Months.	MONTHLY TOTALS.					MAXIMUM FALL IN MONTH.					RAINY DAYS.					No. of Falls of 1·00 in. or more in the whole period.
	Mean 40 Years	EXTREMES.				Mean Max. Fall.	EXTREMES.				Mean.	EXTREMES.				
		Highest Month.		Lowest Month.			Highest.		Lowest.			Highest.		Lowest.		
		Depth.	Date.	Depth.	Date.		Depth.	Date.	Depth.	Date.		Days	Date.	Days	Date.	
	in.	in.		in.		in.	in.		in.							
January...	2·02	4·74	1877	·31	1880	·47	1·20	10th, '66	·13	22nd, '92	15·3	25	'77 &' 94	5	1880	4
February..	1·61	3·77	1879	·01	1891	·40	·76	10th, '79	·01	7th, '91	13·3	24	1879	1	1891	0
March.....	1·71	3·69	1862	·32	1893	·43	·95	3rd, '70	·08	12th, '74	13·7	25	1896	5	'58 & '80	0
April	1·66	4·97	1878	·24	1893	·51	2·56	10th, '78	·08	4th, 12th, 13th, 14th & 29th, '96	12·1	21	1867	3	1893	2
May	1·92	4·79	1886	·14	1896	·60	1·71	7th, '78	·12	17th, '95 / 21st, '96	12·1	21	1887	3	1896	7
June	2·23	6·71	1878	·30	1895	·70	3·28	23rd, '78	·20	18th, '95	11·6	25	1860	3	1887	10
July	2·39	5·10	1880	·45	1868	·71	1·82	25th, '67	·18	3rd, '64	12·7	26	1888	3	'63 & '68	6
August ...	2·39	6·72	1878	·45	1880	·68	1·71	27th, '92	·14	9th, '86	13·3	26	1860	4	1880	6
September	2·39	5·51	1896	·55	1865	·69	1·66	26th, '59	·17	14th, '91	13·1	27	1866	2	1895	7
October ...	2·71	6·22	1865	·56	1897	·66	1·35	30th, '94	·14	18th, '97	15·2	23	'82 & '86	7	'64 & '88	8
November	2·30	4·65	1861	·53	1858	·58	1·42	13th, '61	·17	27th, '58	14·3	22	1877	4	1867	3
December	2·13	6·25	1876	·36	1864	·54	1·82	26th, '86	·12	19th, '64	15·1	27	1868	8	'64 & '73	2
Year*	25·46	34·08	1878	16·93	1864	1·31	3·28	June 23, 1878	·75	Dec. 2nd, 1896	161·8	204	'60 & '72	106	1858	55

* The values in this line relate to the year as a whole, not to the months.

RAINFALL AND TEMPERATURE, MARCH, 1903.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. Nights below 32° In shade.
		inches.	inches.	in.							
I.	London (Camden Square) ...	2·30	+ ·84	·37	2	18	67·9	25	29·9	11*f*	3
II.	Tenterden	2·26	+ ·57	·36	2, 17	20	66·0	25	27·0	11	2
,,	Hartley Wintney	3·97	+ 2·41	·60	23	22	64·0	25	26·0	11	9
III.	Hitchin	3·22	+ 1·78	·65	23	21	66·0	25	29·0	10	7
,,	Winslow (Addington)	3·20	+ 1·68	·71	23	19	66·0	25	29·0	11	8
IV.	Bury St. Edmunds (Westley)	2·12	+ ·49	·47	23	18	64·0	26	29·0	12	5
,,	Norwich (Brundall)	1·73	+ ·12	·33	23	19	64·6	25	28·2	12	4
V.	Winterborne Steepleton	4·82	...	·78	5	21	56·4	25	27·5	12	2
,,	Torquay	4·24	...	·72	1	23	57·9	22	36·0	11	0
,,	Polapit Tamar [Launceston]..	5·86	+ 3·58	·48	17*a*	26	58·0	22	32·0	11	1
VI.	Stroud (Upfield)	3·86	+ 2·18	·51	1, 26	25	63·0	22	32·0	5	1
,,	Church Stretton (Woolstaston)	4·81	+ 3·04	·62	13	26	57·5	24	30·0	2	5
,,	Worcester (Diglis Lock)	...	..	...	...	...	...	...	...	...	...
VII.	Boston	2·81	+ 1·62	·45	23	16	65·0	25	30·0	6	...
,,	Hesley Hall [Tickhill].....	2·54	+ 1·14	·60	17	16	58·0	13*b*	30·0	11	4
,,	Derby (Midland Railway).....	3·43	+ 2·01	·73	17	23	62·0	25	28·0	12	2
VIII.	Bolton (The Park).....	4·04	+ 1·32	·76	17	25	59·8	22	31·2	2	...
IX.	Wetherby (Ribston Hall) ...	3·50	+ 1·87	·77	17	22	...	...	...	...	...
,,	Skipton (Arncliffe Vicarage).	10·69	+ 5·57	1·57	19	29	...	...	...	...	...
,,	Hull (Pearson Park).	2·64	+ ·98	·79	17	16	65·0	25	32·0	11	1
X.	Newcastle (Town Moor)	1·14	— ·80	·22	20	16	...	...	...	...	...
,,	Borrowdale (Seathwaite).....	22·23	+11·57	2·09	20	31	55·5	31	31·3	2	1
XI.	Cardiff (Ely).....	5·75	+ 3·19	·65	1	25	...	...	...	...	...
,,	Haverfordwest	6·44	+ 3·70	·95	18	24	55·3	21	33·2	10	0
,,	Aberystwith (Gogerddan) ...	6·02	+ 3·18	1·08	13	19	56·0	22*c*	...	...	...
,,	Llandudno.....	4·26	+ 2·32	·78	17	23	59·0	23	33·2	18	0
XII.	Cargen [Dumfries]	10·15	+ 7·10	1·22	19	28	55·0	31	32·0	4*g*	4
XIII.	Edinburgh (Royal Observatory)	4·10	...	·48	22	26	54·5	22	30·7	15	4
XIV.	Colmonell	5·65	+ 2·41	·90	22	23	54·0	22	33·0	9	0
XV.	Tighnabruaich	8·62	...	·82	16	30	52·0	31	31·0	7, 13	4
,,	Mull (Quinish).....	7·77	+ 3·60	·88	8	29	...	...	...	...	...
XVI.	Loch Leven Sluices	6·56	+ 3·98	·59	21	26	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	2·40	+ ·42	·30	22	27	55·9	22*d*	28·0	7	6
XVII.	Braemar	6·96	+ 4·64	·86	18	27	50·0	21	23·2	7	11
,,	Aberdeen (Cranford)	1·92	— ·28	·40	16	24	58·0	23	26·0	6	15
,,	Cawdor (Budgate)	3·24	+ 1·00	·51	18	20	...	...	...	...	...
XVIII	Strathconan [Beauly]	7·47	+ 3·25	1·13	19	16	...	...	...	...	...
,,	Glencarron Lodge.....	11·45	+ 4·51	1·21	21	29	55·2	21	26·0	2	11
XIX.	Dunrobin	2·10	— ·34	·40	19	19	52·0	21	29·0	7	6
,,	S. Ronaldshay (Roeberry) ...	2·03	— ·66	·31	27	25	51·0	25	30·0	1, 2	4
XX.	Darrynane Abbey.....	6·25	+ 3·13	·90	22	30	...	...	...	...	...
,,	Waterford (Brook Lodge) ...	5·95	+ 3·43	·63	12	28	54·0	31	31·0	8, 10	4
,,	Broadford (Hurdlestown) ...	5·26	+ 3·06	1·00	22	27	59·0	18	30·0	12*h*	4
XXI.	Carlow (Browne's Hill)	5·98	+ 3·77	·94	12	30	...	...	...	...	...
,,	Dublin (Fitz William Square)	3·62	+ 1·80	·81	12	26	60·7	22	34·1	2	0
XXII.	Ballinasloe	6·45	+ 4·03	·98	22	30	55·0	22	19·0	31	17
,,	Clifden (Kylemore)	10·10	+ 4·91	1·33	24	25	...	...	...	...	...
XXIII	Seaforde.....	5·29	+ 2·88	·61	19	27	58·0	26	28·0	7*i*	12
,,	Londonderry (Creggan Res.).	5·11	+ 2·42	·80	16	28	...	...	...	...	...
,,	Omagh (Edenfel)	7·03	+ 4·45	1·06	23	27	54·0	21*e*	28·0	1	8

+ Shows that the fall was above the average ; — that it was below it.

a and 23, 26. *b* and 20, 21, 26. *c* and 24. *d* and 31. *e* and 25. *f* and 12. *g* and 7, 10, 14. *h* and 13. *i* and 8, 23.

SUPPLEMENTARY RAINFALL, MARCH, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	3·52	XI.	Llandefaelog-fach.....	6·61
II.	Dorking, Abinger Hall .	3·39	,,	New Radnor, Ednol.....	7·97
,,	Sheppey, Leysdown	1·52	,,	Rhayader, Nantgwillt...	12·49
,,	Hailsham	2·69	,,	Lake Vyrnwy	...
,,	Crowborough.....	3·66	,,	Ruthin, Plâs Drâw	5·73
,,	Ryde, Beldornie Tower..	2·70	,,	Criccieth, Talarvor	4·76
,,	Bournemouth, Kempsey	3·31	,,	I. of Anglesey, Lligwy..	5·71
,,	Emsworth, Redlands ...	2·83	,,	Douglas, Woodville.....	3·90
,,	Alton, Ashdell	5·12	XII.	Stoneykirk, Ardwell Ho.	4·00
,,	Newbury, Welford Park	4·49	,,	Dalry, Old Garroch	13·35
III.	Oxford, Magdalen Coll..	2·77	,,	Moniaive, Maxwelton Ho.	11·66
,,	Banbury, Bloxham	3·40	,,	Lilliesleaf, Riddell	5·03
,,	Pitsford, Sedgebrook ...	3·20	XIII.	N. Esk Res. [Penicuick]	6·75
,,	Huntingdon, Brampton.	2·48	XIV.	Dalry, Blair	6·56
,,	Wisbech, Bank House...	2·25	,,	Glasgow, Queen's Park..	7·96
IV.	Southend	1·36	XV.	Inveraray, Newtown ...	11·20
,,	Colchester, Lexden	1·32	,,	Ballachulish, Ardsheal...	13·54
,,	Saffron Waldon, Newport	2·34	,,	Campbeltown, Redknowe	5·24
,,	Rendlesham Hall	1·64	,,	Islay, Eallabus..... ...	6·15
,,	Swaffham	2·30	XVI.	Dollar.....	5·11
V.	Salisbury, Alderbury ...	4·51	,,	Balquhidder, Stronvar...	18·31
,,	Bishop's Cannings	3·72	,,	Coupar Angus Station...	3·91
,,	Ashburton, Druid House	8·72	,,	Blair Atholl	7·02
,,	Okehampton, Oaklands.	6·05	,,	Montrose, Sunnyside ...	3·19
,,	Hartland Abbey	5·54	XVII.	Alford, Lynturk Manse..	1·69
,,	Lynmouth, Rock House	7·30	,,	Keith H.R.S.....	1·07
,,	Probus, Lamellyn	5·23	XVIII.	Fearn, Lower Pitkerrie..	2·52
,,	Wellington, The Avenue	4·28	,,	S. Uist, Askernish	5·96
,,	North Cadbury Rectory	3·54	,,	Invergarry.....	15·94
VI.	Clifton, Pembroke Road	4·44	,,	Aviemore, Alvie Manse.	4·11
,,	Ross, The Graig	3·34	,,	Loch Ness, Drumnadrochit	6·69
,,	Shifnal, Hatton Grange	4·22	XIX.	Invershin	2·69
,,	Wem, Clive Vicarage ...	3·98	,,	Bettyhill	2·23
,,	Cheadle, The Heath Ho.	4·52	,,	Watten H.R.S.....	...
,,	Coventry, Kingswood ...	4·33	XX.	Cork, Wellesley Terrace	5·45
VII.	Market Overton	3·20	,,	Killarney, District Asyl.	12·87
,,	Grantham, Stainby	2·17	,,	Glenam [Clonmel]	7·50
,,	Horncastle, Bucknall ...	3·23	,,	Ballingarry, Hazelfort...	5·33
,,	Worksop, Hodsck Priory	2·58	,,	Miltown Malbay	7·99
VIII.	Neston, Hinderton	3·58	XXI.	Gorey, Courtown House	4·79
,,	Southport, Hesketh Park	2·96	,,	Moynalty, Westland ...	5·64
,,	Chatburn, Middlewood.	5·90	,,	Athlone, Twyford	5·15
,,	Duddon Val., Seathwaite Vic.	10·92	,,	Mullingar, Belvedere ...	6·16
IX.	Langsett Moor, Up. Midhope	6·56	XXII.	Woodlawn	6·48
,,	Baldersby	3·13	,,	Westport, Murrisk Abbey	7·97
,,	Scalby, Silverdale	2·12	,,	Crossmolina, Enniscoe ..	9·55
,,	Ingleby Greenhow Vic..	2·89	,,	Collooney, Markree Obs.	6·84
,,	Middleton, Mickleton ...	3·91	XXIII.	Enniskillen, Portora ...	6·25
X.	Beltingham	3·65	,,	Warrenpoint.....	5·54
,,	Bamburgh	1·29	,,	Banbridge, Milltown ...	3·87
,,	Keswick, The Bank.....	12·98	,,	Belfast, Springfield	4·77
,,	Melmerby Rectory	4·47	,,	Bushmills, Dundarave..	4·26
XI.	Llanfrechfa Grange	6·39	,,	Stewartstown	4·52
,,	Treherbert, Tyn-y-waun	15·84	,,	Killybegs	7·82
,,	Castle Malgwyn	7·94	,,	Horn Head	6·28

METEOROLOGICAL NOTES ON MARCH, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—Generally unsettled and showery, with fine intervals. Remarkably mild. (See p. 43.)

TENTERDEN.—A warm month. Early foliage and blossom were abnormally forward. Duration of sunshine 154·5 hours. TS in S.E. on evening of 26th.

SHEPPEY, LEYSDOWN.—Almost incessant strong winds and gales from S. and S.W. At 7 p.m. on 25th, the shade temp. was 64°. L on 23rd, 24th and 25th.

CROWBOROUGH.—Very wet, R 1·26 in. above the average of 27 years. Mean temp. 43°·8, and ground frost on 11th and 12th only. Much sun and more than usual strong wind. H on 7th, 16th and 30th.

EMSWORTH, REDLANDS.—Continual gales. The 25th, a very warm day, wound up with a short TS. T and L on 1st and 25th and L on 26th.

HITCHIN.—An extraordinary month for temp. The mean on 25th, 55°, was the highest ever recorded. The mean for the month, 44°·1, was the highest except 1893, 44°·8, and a singular contrast to 1883, with 32°·9.

WINSLOW, ADDINGTON.—R very much above average, and, with one exception, 3·60 in. in 1876, the greatest since 1871. Vegetation very forward.

PITSFORD, SEDGEBROOK.—Remarkable for excessive R, high temp. and strong winds. R 1·50 in. above the average of 10 years. Mean temp. 45°·1.

NORWICH, BRUNDALL.—Mean temp. 45°·6, being higher than any March since 1882. Vegetation very forward. Much L in evening on 25th.

TORQUAY, CARY GREEN.—R 1·71 in. above the average. Duration of sunshine 133·1 hours, or 6·6 hours below the average. Mean temp. 47°·7, or 3°·8 above the average. Mean amount of ozone 6·3; max. 8·5 on several days, min. 3·5 on 11th, with W. wind.

LYNMOUTH, ROCK HOUSE.—Mild throughout, with strong winds from S.W. or W., and no frost. H on 4 days. T and L on 31st.

WELLINGTON.—One of the stormiest and wettest Marches for many years.

NORTH CADBURY RECTORY.—The windiest month ever experienced, with only two quiet days. All this wind blew from S.—W., mostly S.S.W., with extraordinary pertinacity and vehemence. Though R was frequent, the roads kept dry, but the fields soaking, making seeding most difficult. High temp., especially at night, with small range. Vegetation very forward.

CLIFTON, PEMBROKE ROAD.—Very wet, with no settled weather. R nearly double the average, and the greatest since 1889. H on 1st and 6th.

ROSS, THE GRAIG.—A record month. No frost in screen, and only three frosts since January 18th. R 1¾ times the average and number of rainy days in excess of any previous March. Mean temp. 46°·0. The mean max., 51°·9, has been frequently exceeded, but the mean min., 40°·2, is the highest since at least 1859, and probably much longer. Frequent heavy gales from S.W. and W. Vegetation the earliest remembered.

BOLTON, THE PARK.—Mild, changeable and windy. Vegetation was fully a month ahead of the average at the end. The distance travelled by the wind exceeded the average by 36 per cent. Mean temp. 42°·7, or 3°·3 above the average. Duration of sunshine 51 hours 50 minutes, or 28 hours below the average. Two inches of S, the heaviest of the season, fell on 2nd, and a smaller fall on 17th. H on 28th and 30th.

ARNCLIFFE VICARAGE.—January, February and March were the wettest three months ever known in this district.

HULL, PEARSON PARK.—Wind generally S.W., and at times strong, but on the whole warm. S on 2nd and 3rd; L on 25th; TS on 26th.

WALES AND THE ISLANDS.

LLANFRECHFA GRANGE.—Unusually wet and stormy, with the heaviest R in March since observations began in 1865, the nearest approach being 6·03 in. in 1873. T, L and H on 26th.

HAVERFORDWEST.—Gales 1st and 2nd, and from 17th to 25th. Almost entire absence of frost. Blackthorn in bloom on 22nd; vegetation forward, but farm work impeded by the continual wet. Duration of sunshine 77·5 hours.

DOUGLAS, WOODVILLE.—March, like January and February (but worse), was wet, very rough and stormy, no consecutive 24 hours being calm, and very sunless. Probably the worst and stormiest three months within general memory. Although mild, there was little sign of spring at the end, the direct effect of the wind.

SCOTLAND.

CARGEN [DUMFRIES].—Nothing like the R of this month has been experienced since observations were commenced, the nearest being 5·91 in. in 1897. The fall for the first three months of the year is 22·09 in., a figure not reached till September 3rd of last year. Farm work is terribly backward, not a seed sown and much land unfit for horse labour. Vegetation, on the other hand, is unusually forward. Strong S.W. winds prevailed.

MONIAIVE, MAXWELTON HOUSE.—Very wet and stormy. R on 31 days and 8·22 in. above the average. The fall for the last three months was 26·59 in., or 15·46 in. above the average. All low ground was constantly flooded and farming operations were stopped.

LILLIESLEAF, RIDDELL.—Very remarkable for frequency and quantity of R, and for continuous high wind. In 39 years there has been nothing like it, and the previous highest was 3·72 in. in 1897. The temp. was much higher than usual. The hedges and young larches came out before the middle of the month, in sheltered places. Ploughing was checked for every field was a bog.

DALRY, BLAIR.—Not one day without R, making 41 rainy days in succession.

TIGHNABRUAICH.—Only one day on which R did not fall, and since January 1st R has been excessive, the total being 24·94 in. Many gales and frequent sheet L.

BALLACHULISH, ARDSHEAL.—R 7·75 in. above the average. A heavier monthly fall has only twice been recorded. Continued gales from 18th to 29th, preceded by T and L on 17th.

COUPAR ANGUS.—Absence of morning frosts and of bright sunny days. High mean temp., and R almost double the average. Mean temp. 40°·9.

BLAIR ATHOLL.—High temp., and the most excessive R for 25 years.

DRUMNADROCHIT.—As in February, R was the second largest for the last 17 years, more than double the average. The fall for the first three months of 1903 was 21·14 in., or 11·94 in. above the average. Extensive and serious flooding of low lands accompanied by the bursting of river banks and injury to roads.

S. RONALDSHAY, ROEBERRY.—Very unsettled and windy. Several severe gales from S.W. and W., from which direction it blew with very few exceptions, the entire month. Mean temp. 40°·5, or 1°·5 above the average.

IRELAND.

CORK, WELLESLEY TERRACE.—The greatest R for 25 years, except 1897 with 5·57 in. Mean temp. 40°·6. The R of the first three months of the year was 6·99 in. over the average.

MILTOWN MALBAY.—The most inclement, wet and stormy March in memory, with heavy H, T and sheet L. No agricultural work could be done.

WATERFORD, BROOK LODGE.—Very wild and wet, being the wettest March for over 50 years. Mean temp. 44°·2.

BROADFORD, HURDLESTOWN.—The wettest March on record.

CARLOW, BROWNE'S HILL.—The R exceeded that of any March since the record was commenced in 1866.

DUBLIN, FITZWILLIAM SQUARE.—Stormy, blustering, rainy and open. Though the mean temp., 45°·6, was 2°·0 above the average, it was 1°·9 below the mean of February, 1903. R very frequent and often heavy. The wind reached gale-force on 11 days. S or sleet on 4 days and H 4 days.

BALLINASLOE.—The worst March for 32 years. Constant R and heavy storms.

OMAGH, EDENFEL.—R was by far the heaviest in March in 38 years, the next being 4·47 in 1868.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1902.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	66·2	10	32·7	19	57·2	44·7	46·3	87	102·9	29·3	1·46	17	7·5
Malta	82·9	11	55·2	27	76·0	65·2	62·6	80	136·1	50·9	6·35	9	4·7
Lagos, W. Africa	88·1	12	70·1	2, 3	84·5	75·0	74·6	80	148·0	...	3·30	10	...
Cape Town	83·8	8	48·7	18	70·9	54·8	52·9	70	...	...	4·72	8	4·2
Durban, Natal	91·2	13	51·3	5	77·6	59·8	...	...	144·4	...	2·23	17	5·9
Mauritius	85·8	17	61·0	23	82·4	66·9	63·8	71	151·4	53·0	1·94	9	5·6
Calcutta	93·0	12	69·6	26	88·4	74·0	71·7	74	155·9	65·9	2·78	4	4·1
Bombay	92·9	28	74·2	14	89·6	78·9	75·7	77	142·5	69·8	·78	5	4·9
Madras	92·7	18	68·6	20	87·9	73·9	73·5	83	147·7	65·2	20·69	18	5·3
Kodaikanal	67·5	1	45·7	21	62·4	51·1	52·3	89	145·0	37·2	16·85	21	6·8
Colombo, Ceylon	90·7	1	72·7	25*a*	86·5	74·1	73·4	85	152·9	71·0	31·47	29	7·3
Hongkong	86·3	3	65·4	31	81·1	73·3	66·3	70	142·1	...	·94	4	3·6
Melbourne	82·5	2	39·0	16	67·0	49·0	47·6	75	144·1	31·0	·76	7	6·0
Adelaide	95·0	21	42·9	11	74·2	53·7	46·4	56	151·3	39·8	1·77	14	5·0
Coolgardie	94·0	12	40·3	2	77·4	50·7	...	...	165·3	33·4	3·09	5	3·6
Sydney	81·1	10	50·4	17	69·4	57·4	...	73	121·4	44·7	10·81	16	5·6
Wellington	65·0	14*a*	35·0	3	59·0	43·8	42·8	74	119·0	28·0	3·06	13	5·6
Auckland	68·0	31	41·0	6	60·0	48·9	44·1	68	132·0	38·0	2·74	16	6·0
Jamaica, Negril Point	88·6	17	70·1	29	86·7	72·8	73·3	80	...	...	5·58	17	...
Trinidad	93·0	31	69·0	sevl	87·9	70·3	76·1	92	169·0	66·0	7·40	12	...
Grenada	88·0	6	71·4	21	84·5	74·6	72·4	77	160·0	...	5·63	15	2·8
Toronto	68·1	19	26·4	30	57·3	39·9	42·8	79	88·0	20·4	2·78	11	6·0
Fredericton, N.B.	70·0	2	18·9	24	55·4	35·7	33·8	59	...	...	4·99	8	5·7
Winnipeg	72·0	5	14·0	9	53·3	30·5	...	...	...	...	1·23	7	5·4
Victoria, B.C.	70·4	3	38·7	19	57·9	46·9	48·1	86	...	...	1·09	13	6·3
Dawson	68·0	1	7·8	22	35·8	23·8	...	...	...	...	·92	7	4·3

a—and 28.

MALTA.—Mean temp. of air 69°·3, or 0°·2, below average. Mean hourly velocity of wind 10·6 miles or 1·8 above average. Mean temp. of sea 73°·5. TS8 on 3 days, J. F. DOBSON.

Mauritius.—Mean temp. of air 1·3 above, of dew point 1°·6 above, rainfall ·36 in. above, and mean hourly velocity of wind 0·4 mile below, average. T. F. CLAXTON.

MADRAS.—Sunshine 138·7 hours, or 38·0 per cent. of possible amount.—A. MOFFAT.

COLOMBO.—Mean temp. of air 0°·9 above, of dew point 0°·5 above, and R 17·44 in. above, average. Mean hourly velocity of wind 5·2 miles, TS8 on 14 days. H. O. BARNARD.

HONGKONG.—Mean temp. 76°·7. Bright sunshine 234·7, or 20 hours above average. R 4·42 in. below average of 39 years. Mean hourly velocity of wind 14·1 miles; prevailing direction E. F. G. FIGG.

Adelaide.—Mean temp. 64°·0, or 2°·0 above average. Fair average rains in the agricultural districts, but no relief from drought in the interior. C. TODD, F.R.S.

Coolgardie.—Mean temp. 1·3 in. below average. R in excess of average. W. ERNEST COOKE.

Sydney.—Mean temp. 0°·1 below, humidity 4°·9 above, and R 7·85 in. above, average. H. C. RUSSELL, F.R.S.

Wellington.—Mean temp. 2°·2 below, and R 1·31 in. below, average. A. H. GORE.

Auckland.—Mean temp. quite 3°·0 below the average of 33 years. T. F. CHEESEMAN.

Trinidad.—R ·63 in. above the 40 years' average. J. H. HART.

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METEOROLOGY ON THE BRITISH ANTARCTIC EXPEDITION NEAR MOUNT EREBUS.

THE relief ship "Morning" succeeded in communicating with the "Discovery" and bringing home a full account of the most important Antarctic voyage which has yet been made. After a cruise along the edge of the great ice barrier in the southern summer of 1901–02 the "Discovery" went into winter quarters in a sheltered position 21 miles from Mount Erebus in latitude 77° 49′ S., longitude 166° E., and here the winter was passed farther south than men had ever wintered before. During the Antarctic summer of 1902–03 sledging expeditions went out in various directions, and Captain Scott, the leader of the expedition, with Dr. Wilson and Lieutenant Shackleton, succeeded in reaching 82° 17′ S. along a newly-discovered coast line, thus getting 207 nautical miles beyond the farthest south previously attained. The "Discovery" remained fast in the ice when the "Morning" left.

We have received letters from the captain, officers, and scientific staff describing their experiences and giving a preliminary account of their results. While the interest is on the whole mainly geographical, the letter (dated 16th February, 1903) from Lieutenant Charles Royds, R.N., who is in charge of the meteorological observations on board, will be welcome to our readers as giving new and thoroughly trustworthy information about the Antarctic climate. We publish the subjoined extracts with the approval of Captain Scott and Sir Clements Markham :—

"We are in a good southern latitude for observations, and without doubt are much influenced by the ice barrier. Actually in our winter quarters we are protected and sheltered by hills from N. through E. to S.S.E., and our temperatures are accordingly higher than those recorded clear of the land. The winds, on the other hand, which always blow from the E. and S.E., often have a force of 4 to 5 Beaufort at the ship, while a mile clear of the land there are only light airs or a calm. Our gales during the winter began from the E., working round to S. and S.W., when it blew its hardest, and gradually working back to E. The barometer gave absolutely no warning of gales during the winter, but during the summer the barometer generally falls for a blow. Northerly winds seem most prevalent during the summer months, and I do not think they were ever recorded in winter.

E

"Mount Erebus has been most useful for recording the direction of the upper air-currents, and the trend of the smoke from the crater was always logged when seen. The upper winds appear to be usually south-westerly or westerly.

"The auroral displays were not very brilliant, but although I have not really gone into the question, I believe we generally got a blow after a more than usually bright aurora.

"During the winter the wet bulb never worked, and always read some degrees higher than the dry; but once the temperature got above zero it was all right. During the winter I made some experiments for humidity by weighing a dish of water (ice) daily, and got some pleasing results which may prove useful when taken in conjunction with the readings of the hair hygrograph. All recording instruments are most troublesome, as they get choked up during blizzards. The Dines anemometers, small and recording patterns, have been at work; but when it is snowing or drifting much the vanes have to be cleared two-hourly. The recording instruments always got choked in the highest wind, so that no record was obtained above 50 miles an hour; but 65 to 70 miles an hour has been indicated here by the Robinson anemometer, which once showed 90 miles an hour off Coulman Island in a howling gale. The sunshine recorder has worked excellently, and we have about two dozen 24-hourly records.

"It was impossible to measure the snow-fall, for in the southerly blizzards we could not say whether snow was falling or only drifting, and the gauges were absolutely useless. These blizzards are pretty specimens of what pranks Nature can play, and Heaven protect the man who gets more than a couple of yards away from the shelter of the ship unless he has something to guide him, as the air is a mass of whirling drift (or snow) and you absolutely can see nothing, and unless you can keep your head (as you cannot help keeping cool!) you soon find that you are lost.

"According to my calculations, which are rough and from the uncorrected temperatures, our daily mean for the year is about zero Fahrenheit. Even as early as March I got a temperature of $-42°$ on the barrier while doing an autumn journey, and the lowest recorded by the thermometer $1\frac{1}{2}$ miles away from the ship was $-62°$ in August, while on board at the same time it was $-50°{\cdot}5$. The highest readings were 39° in December, 1902, and January, 1903, and $41°{\cdot}5$ in January, 1902. The range of temperature between the monthly maximum and minimum varies from about 30° in summer to about 60° in winter. It is a very remarkable thing that during our southerly blizzards in mid-winter the temperature invariably rose sometimes to $+19°$ F., and then fell again to $-30°$ or under as soon as the wind returned to the eastward.

"During the sledge journeys observations were made every two hours to compare with those at the ship, and I think these should prove very valuable."

Mr. Royds sends the following table of mean and extreme temperatures at winter quarters for January, 1903, and February to December, 1902 :—

Temp.	Jan.	Feb	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mean..	24·9	15·8	7·3	— 7·5	—12·9	—16·4	— 8·6	—17·2	—13·2	— 9·0	12·2	23.4	— 0·1
Max....	39·0	29·2	27·5	19·5	19·0	13·0	15·0	6·0	15·0	11·8	27·8	39·0	39·0
Min. ..	8·0	— 0·8	—13·2	—31·6	—39·5	—47·0	—38·0	—50·5	—44·5	—41·8	0·0	4·2	—50·5

The yearly mean of the uncorrected barometer was 29·228 inches, the highest monthly mean 29·542 in November, the highest reading 30·088; the lowest monthly mean was 28·762 in August, and the lowest reading 28·096.

The high temperature of the southerly wind blowing straight from the Pole at mid-winter must not be taken as an indication of a warmer climate farther south. It is probably a Föhn effect due to the thermo-dynamic heating of air descending from the summits of the great mountain ranges which were seen to the south. Similar phenomena have, however, been observed in the Arctic regions, especially during the drift of the "Fram," when there were no mountains near, and it may be that a descending rush of air is brought about near the Poles by some other agency.

Correspondence.

THE TEMPERATURE OF APRIL, 1903.

To the Editor of Symons's Meteorological Magazine.

The cold weather of April, 1903, though unusual, is not unprecedented even in recent years. The average minimum temperature here for fourteen consecutive nights has been, in 1903, April 13th–26th (inclusive) 29·4, while in 1892 for the ten days ending April 19th, the average minimum was only 26·4; in the latter period the lowest minima were 20·2 and 21·7 on the 19th and 14th respectively; while in 1903 the lowest were 26·6 and 26·7 on the 19th and 18th. In 1891 also the average temperature of the whole month was 40·4 against 41·8 in 1903.

The really unusual feature about the past month is that it was colder than *both* February and March. I have examined the published records for Edinburgh, London, and Paris, from which it appears that we have to go back to 1809 for a similar instance, in which year April was colder than both the preceding months in London and Paris, but not in Edinburgh. In the year 1790 also London and Edinburgh show the same feature, the Paris records not extending so far back.

I may note also that the rainfall here in March this year was the largest since 1881, 7·89 in., or more than double the average.

CHARLES L. BROOK.

Harewood Lodge, Meltham, 3rd May, 1903.

THE FORMATION OF CUMULUS CLOUD.

To the Editor of Symons's Meteorological Magazine.

I suppose no one doubts that a cumulus cloud is formed by an upward current of air, but when experimenting with a kite on April 29th I had a plain proof of the fact. A kite was left flying at the end of 2700 feet of wire, and flew at an angle of about 40°. A large and well-defined cumulus cloud then passed over, and the angular elevation of the kite increased rapidly until it reached the high value of 74°; an angle exceeding 70° being maintained for quite ten minutes while the cloud was overhead. The wind was blowing from south-south-west at a rate of, perhaps, 18 miles per hour, judged by the pull upon the wire, and was very uniform up to a height of 2500 feet. In such a wind the ordinary angle of the kite with 2700 feet of wire would be rather over 45°, so that we must suppose that the wind at a height of 2500 feet was inclined upwards at an angle of nearly 30°. This would give an upward component to the air of from 12 to 15 feet per second. A few heavy drops of rain fell from the cloud, and a fairly heavy shower seemed to be falling from it when it had passed a few miles away to the north. Its lower surface was above 2550 feet high, how much above I cannot say, as it was not reached by the kite. The temperature at the ground level was 57° F., at 2550 feet it was 43° F.

Oxshott, April 30th, 1903. W. H. DINES.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Easter Wednesday, April 15th, at the Institution of Civil Engineers, Great George Street, Westminster. Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

Mr. J. R. Sutton, M.A., was elected a Fellow of the Society.

Mr. F. J. Brodie read a paper on "The prevalence of gales on the coasts of the British Islands during the thirty years, 1871-1900," being a continuation of a paper on the same subject which he communicated to the Society last year. The average annual numbers of gales were: West coasts, 29·6; north coasts, 25·7; south coasts, 19·1; and east coasts, 15·6. The most stormy years were: West coasts, 1877 with 41 gales; north coasts, 1877 with 40 gales; south coasts, 1883 with 34 gales; and east coasts, 1877 and 1883 both with 26 gales. On the west coasts the actual maximum of gale prevalence occurs at two different times in the year, once in the five-day period, November 12th–16th, and again in the periods December 27th–31st, and January 1st-5th. On the north coasts the maximum prevalence occurs in the five-day period January 21st–25th, secondary maxima being shown in the early parts both of that month and of December. On the south coasts the actual maximum occurs in the five-day period November 7th–11th, but subsidiary maxima of almost equal intensity are recorded at precisely the same time in December and in the period January 21st–25th. On the east coasts the maximum frequency is very pro-

nounced, and occurs in the five-day period November 7th–11th, the succeeding five days being, however, almost as stormy.

Dr. R. H. Scott said that he was glad to find that Mr. Brodie's figures proved that the old idea of equinoctial gales was groundless, and that they did not exist as a constant occurrence.

Mr. C. Harding referred to the relationship between barometric pressure and wind, and said that it did not necessarily follow that the stormiest month had the isobaric lines lying most closely together; but generally in the month when storms were most frequent the variations and range of pressure were very marked.

Mr. W. H. Dines said that from his experience with kite-flying he had found that inland it was often blowing very hard at 2000 feet elevation when it was nearly calm at the surface, but that this rule did not hold when kites were flown from a vessel over the sea. Inland the isobars gave a perfectly reliable estimate of the wind force at an elevation of 1000 to 2000 feet, but they only gave a rough approximation to the wind force at the surface; it seemed likely, therefore, that winds blowing from the land would be much lighter on the coast than they would be 20 miles or so out at sea.

The President, Mr. F. C. Bayard, and Mr. R. H. Curtis also took part in the discussion, and Mr. F. J. Brodie briefly replied.

A paper by Mr. J. Baxendell on "The Duration of Rainfall" was read by the Secretary. The author referred to various patterns of self-recording raingauges and pointed out their defects and advantages, and also stated that it is hardly possible to determine from some of them the rate at which rain falls, especially in very small quantities. The records of a Halliwell self-recording raingauge, which had been in operation at Southport during 1902 gave the total rainfall for the year as 25·42 inches, and the duration 640·1 hours. The author showed that the hourly duration values give a striking curve of diurnal variation, the early morning maximum being most pronounced; the afternoon maximum is also present, but is much less protracted and of far less amplitude than the former. Minima occur about mid-day and in the evening. Mr. Baxendell concluded his paper by giving a description of the improved gauge referred to.

Mr. R. H. Curtis exhibited diagrams showing the mean hourly amounts of rain recorded by the Beckley self-recording raingauge at Valencia, Aberdeen, Falmouth, and Kew.

Mr. Baldwin Latham said he would like to see self-recording raingauges placed all over the country. Last year at Croydon the average hourly rate of rainfall was small, being only ·039 inch, but the number of hours (539·3) was considerable.

Mr. J. Hopkinson said that the peculiarity at Southport last year of the small total rainfall but great number of days of rain would probably be found to have been general over England. It was similar to that experienced in Hertfordshire, where the number of rainy days was excessive in comparison with the amount of rainfall, which was much below the average. Both "total" and "partial" droughts were absent, and the little rain which did fall was so frequent and continuous as to *give a general impression* that it was a wet year.

THE CANADIAN CLIMATE.

By R. F. STUPART, Director Meteorological Service, Dominion of Canada.

(*Concluded from p. 33.*)

THE following maps and tables indicate the observed temperatures, uncorrected for height above the sea, at representative stations in all parts of the Dominion of Canada.

TABLE I.—*The Average Mean Highest, Mean Lowest and Mean Temperature; the Highest and Lowest Temperature and Mean Daily Range; also Percentage of Cloud and Precipitation in inches at various stations in Canada.*

Temperatures not reduced to sea-level. Mean temp. is taken as $\frac{\text{Max.}+\text{Min.}}{2}$

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
VICTORIA, B.C. .....(16 years)													
Lat. 48° 24′ N.; Long. 123° 19′ W. Height 85 ft.													
Mean Highest	41·9	44·1	48·9	54·9	61·6	65·5	70·9	69·2	63·8	55·8	48·3	45·5	70·9
,, Lowest	33·1	34·1	36·1	39·4	44·2	47·8	49·6	49·8	46·1	43·7	38·8	37·0	33·1
,, Temperature	37·5	39·1	42·5	47·2	52·9	56·6	60·3	59·5	55·0	49·7	43·6	41·3	48·8
,, Daily Range	8·8	10·0	12·8	15·5	17·4	17·7	21·3	19·4	17·7	12·1	9·5	8·5	...
Absolute Highest.....	56	60	68	75	83	86	90	88	85	70	63	59	90
,, Lowest	-1	6	17	29	31	36	37	37	30	22	17	8	-1
Per cent. of Cloud	78	75	67	65	61	60	42	42	53	67	79	79	64
Precipitation (Rain and Melted Snow)	5·28	4·03	2·92	2·42	1·44	1·20	0·40	0·60	2·16	2·37	6·97	7·98	37·77
KAMLOOPS, B.C. .....(12 years)													
Lat. 50° 41′ N.; Long. 120° 29′ W. Height 1195 ft.													
Mean Highest	30·7	33·7	46·9	60·5	70·2	75·6	81·8	82·1	69·5	56·8	40·0	35·3	82·1
,, Lowest	17·7	18·5	27·6	37·6	45·9	51·3	54·8	54·9	46·1	39·1	28·3	24·9	17·7
,, Temperature	24·2	26·1	37·2	49·0	58·0	63·5	68·3	68·5	57·8	48·0	34·2	30·1	47·1
,, Daily Range	13·0	15·2	19·3	22·9	24·3	24·3	27·0	27·2	23·4	17·7	11·7	10·4	...
Absolute Highest.....	56	64	69	78	100	101	101	101	87	82	65	56	101
,, Lowest	-27	-27	-5	25	26	39	44	39	31	16	-22	-16	-27
Per cent. of Cloud	69	69	51	56	58	56	48	50	46	58	65	70	58
Precipitation	0·86	0·79	0·51	0·37	1·11	1·42	1·61	1·09	0·85	0·61	1·46	0·78	11·16

TABLE I.—*(continued.)*

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
CALGARY, N.W.T. ..... (18 years) Lat. 51° 2′ N.; Long. 114° 2′ W. Height 3389 ft.													
Mean Highest	21·9	24·3	35·9	52·6	63·6	68·9	74·9	73·7	63·7	54·9	35·9	30·1	74·9
,, Lowest	0·0	1·8	12·4	26·7	35·7	42·4	46·5	44·9	36·8	28·1	13·9	10·8	0·0
,, Temperature	11·0	13·0	24·2	39·6	49·7	55·6	60·7	59·3	50·3	41·5	24·9	20·5	37·5
,, Daily Range	21·9	22·5	23·5	25·9	27·9	26·5	28·4	28·8	26·9	26·8	22·0	19·3	...
Absolute Highest.....	58	59	75	77	90	94	95	95	89	85	70	58	95
,, Lowest	-40	-49	-34	-14	12	26	31	30	17	-8	-31	-39	-49
Per cent. of Cloud	41	48	48	51	53	49	43	37	44	41	42	47	45
Precipitation.....	0·52	0·66	0·75	0·67	1·78	2·45	2·68	2·14	1·36	0·48	0·88	0·59	14·96
WINNIPEG, MANITOBA...(22 years) Lat. 49° 53′; Long. 97° 7′. Height 760 ft.													
Mean Highest	3·6	12·0	24·3	47·0	64·2	74·9	78·1	75·8	64·1	49·5	26·9	14·1	78·1
,, Lowest	-17·8	-13·0	0·4	24·6	38·6	49·9	53·4	50·2	40·6	28·6	8·7	-5·9	-17·8
,, Temperature	- 7·1	- 0·5	12·3	35·8	51·4	62·4	65·7	63·0	52·3	39·0	17·8	4·1	33·0
,, Daily Range	21·4	25·0	23·9	22·4	25·6	25·0	24·7	25·6	23·5	20·9	18·2	20·0	23·0
Absolute Highest.....	40	46	62	90	95	96	96	98	94	86	64	45	98
,, Lowest	-48	-46	-38	-14	15	21	36	30	19	-3	-34	-53	-53
Per cent. of Cloud	52	50	48	50	51	49	45	45	53	63	63	57	52
Precipitation.....	0·86	0·97	1·00	1·59	2·21	3·29	3·08	2·67	2·03	1·70	1·08	0·91	21·39
TORONTO ..... (60 years) Lat. 43° 40′; Long. 79° 24′ W. Height 350 ft.													
Mean Highest	28·9	29·6	35·6	48·9	61·3	72·0	77·4	75·6	67·5	54·1	42·0	32·2	77·4
,, Lowest	14·9	14·5	21·4	32·8	42·9	52·7	57·9	57·0	49·9	38·7	29·9	19·6	14·5
,, Temperature	21·9	22·0	28·5	40·8	52·1	62·4	67·6	66·3	58·7	46·4	36·0	25·9	44·1
,, Daily Range	14·0	15·1	14·2	16·1	18·4	19·3	19·5	18·6	17·6	15·4	12·1	12·6	...
Absolute Highest.....	58	54	70	90	93	93	98	99	94	81	67	61	99
,, Lowest	-26	-25	-16	6	25	28	39	40	28	16	-5	-21	-26
Per cent. of Cloud	74	69	63	58	57	52	50	50	50	62	75	76	61
Precipitation	2·90	2·58	2·67	2·42	3·06	2·88	2·99	2·87	3·27	...	...	...	...

TABLE I.—*(continued.)*

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
MONTREAL .....(24 years) Lat. 45° 30′ N.; Long. 73° 35′ W. Height 187 ft.													
Mean Highest	20·7	23·4	30·7	49·0	64·0	73·7	77·4	75·1	66·5	52·9	38·7	26·2	77·4
,, Lowest	4·4	7·4	16·9	32·8	45·8	56·4	60·8	58·9	50·8	34·0	26·6	12·1	4·4
,, Temperature	12·3	15·6	24·3	40·6	54·7	65·0	68·9	66·8	58·5	46·0	31·7	19·2	42·0
,, Daily Range	16·3	16·0	13·8	16·2	18·2	17·3	16·6	16·2	15·7	13·9	12·1	14·1	...
Absolute Highest.....	52	50	57	77	92	98	94	90	91	78	68	59	98
,, Lowest	-26	-24	-15	8	25	38	46	45	33	22	-1	-21	-26
Per cent. of Cloud	61	59	56	53	58	53	52	53	49	59	72	66	58
Precipitation.....	3·73	3·07	3·79	2·24	2·95	3·53	4·29	3·57	3·30	3·13	3·74	3·65	40·99
FREDERICTON, N.B...... ..(24 years) Lat. 45° 57′; Long. 66° 36′. Height 164 ft.													
Mean Highest	23·3	26·3	35·2	48·9	63·2	72·2	75·9	73·6	65·5	52·3	41·7	27·3	75·9
,, Lowest	2·8	3·9	16·0	28·1	39·9	49·1	54·4	53·5	44·9	34·4	24·9	9·0	2·8
,, Temperature	11·8	15·8	25·4	37·9	51·1	60·6	66·0	64·1	56·2	44·1	32·0	18·6	40·3
,, Daily Range	20·5	22·4	19·2	20·8	23·3	23·1	21·5	20·1	20·6	17·9	16·8	18·3	...
Absolute Highest.....	52	51	65	77	92	97	96	95	88	82	64	58	97
,, Lowest	-34	-30	-27	-4	24	32	38	39	25	15	-16	-31	-34
Per cent. of Cloud	52	55	52	53	58	55	51	53	55	55	64	54	55
Precipitation.....	2·43	3·76	4·12	2·59	4·23	3·64	3·79	4·18	3·21	3·93	4·21	3·62	43·71
CHARLOTTETOWN, P.E.I. (24 years) Lat. 46° 14′; Long. 63° 10′. Height 38 ft.													
Mean Highest	24·0	25·3	31·3	41·4	54·8	66·4	71·6	72·2	63·7	52·8	40·1	29·8	72·2
,, Lowest	6·2	7·0	16·0	27·4	37·7	49·0	56·2	57·1	49·7	40·2	28·3	15·9	6·2
,, Temperature	15·1	16·1	23·7	34·4	46·3	57·7	63·9	64·7	56·7	46·5	34·2	22·9	40·2
,, Daily Range	17·8	18·3	15·3	14·0	17·1	17·4	15·4	15·1	14·0	12·6	11·8	13·9	...
Absolute Highest.....	50	47	53	68	79	85	88	88	82	74	63	52	88
,, Lowest	-27	-17	-14	2	26	36	42	44	34	26	1	-18	-27
Per cent. of Cloud	61	58	64	57	57	58	53	59	52	70	71	71	61
Precipitation.....	4·06	3·25	3·09	2·61	3·06	2·60	3·43	3·96	3·35	4·65	3·74	3·98	41·78

TABLE I.—*(continued.)*

HALIFAX, NOVA SCOTIA (24 years) Lat. 44° 39′ N.; Long. 63° 36′ W. Height 97 ft.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
Mean Highest	30·9	31·6	36·5	46·6	58·4	68·2	73·9	74·3	67·6	56·2	44·2	34·3	74·3
,, Lowest	13·1	13·9	20·8	29·9	38·9	47·0	54·4	55·4	48·8	39·8	32·2	19·7	13·1
,, Temperature	22·0	22·7	28·7	38·2	48·7	57·6	64·2	64·8	58·2	48·0	38·2	27·0	43·2
,, Daily Range	17·8	17·7	15·7	16·7	19·5	21·2	19·5	18·9	18·8	16·4	12·0	14·6	...
Absolute Highest	55	50	55	76	88	93	93	93	85	80	65	55	93
,, Lowest	-16	-17	-9	7	24	33	41	42	32	23	4	-11	-17
Per cent. of Cloud	61	59	64	61	62	61	58	57	53	54	64	64	60
Precipitation	5·63	4·94	5·15	4·00	4·43	3·68	3·43	3·96	3·53	5·21	5·26	5·52	54·74

TABLE II.—*Percentage of Bright Sunshine at Thirteen Stations in the Dominion* (100 *being constant sunshine*).

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR.
Victoria, British Columbia	20	23	38	39	41	41	56	55	44	35	20	15	36
Agassiz, ,, ,,	18	19	25	24	31	33	46	45	31	28	17	13	28
Battleford, North West Territories	32	39	49	52	49	54	58	54	49	56	31	27	46
Indian Head ,, ,,	30	34	37	38	46	47	55	49	42	34	24	24	38
Brandon, Manitoba	40	46	44	44	47	56	56	55	49	36	40	36	46
Winnipeg, ,,	42	47	51	50	54	56	57	59	47	36	34	36	47
Woodstock, Ontario	21	29	31	43	54	53	58	55	49	39	25	20	40
Barrie, ,,	19	28	38	45	44	51	56	56	48	34	19	16	38
Toronto, ,,	27	36	43	50	50	56	60	59	58	42	28	23	44
Lindsay, ,,	24	35	44	51	47	55	57	55	53	38	25	21	42
Kingston, ,,	27	36	44	49	47	54	58	57	51	41	27	26	43
Montreal, Quebec	33	42	46	51	51	55	59	58	54	42	28	27	45
Fredericton, New Brunswick	40	44	42	46	45	47	50	50	48	43	32	31	43

REVIEW.

London Fog Inquiry, 1901-02. *Report to Meteorological Council, by* Captain ALFRED CARPENTER, R.N., D.S.O. London: Printed for H.M. Stationery Office, 1903. Size 12 × 10. Pp. 28. Plates.

THE London County Council, after receiving Captain Carpenter's report on the Fog Inquiry, has, we regret to say, resolved to discontinue the subsidy which had made it possible to carry on systematic observations during the winter of 1901-02. This is unfortunate, because the first season's work with a body mainly composed of inexperienced observers is necessarily largely a matter of organizing and training a staff, which in a second season would be much more efficient, and immediate results which would enable fogs to be predicted with unerring precision could not be expected.

There were 46 places of observation at parks, fire brigade, police, and coastguard stations in all parts of London and the immediate surroundings, but they were not all at work until January 5th, 1902. Three varieties of fog were noted: (1) thin fog or mist, which slightly hinders traffic by river and rail but not by road; (2) moderately thick fog which hinders all traffic and makes it impossible to discern a man by day more than 100 yards away; and (3) dense fog which stops all traffic on the river and makes it very slow by road or rail, while in the daytime an object cannot be distinguished across the street. In addition to this, darkness due to high fog, but not interfering with lights at the street level was also taken into account. Special observations were made at considerable heights on the top of the dome of St. Paul's and on the Victoria Tower of the Palace of Westminster.

It was found that light fogs were so frequent that they could be considered to be permanent features of London in winter, and so they are left out of account as far as regards frequency. Regent's Park and Kingsland Road, N., had fog on 59 days between 15th December and 14th March; Bermondsey came next with 42 days; Camberwell, Clerkenwell, and Regent Street had 26 days; Southwark, Poplar, and the Isle of Dogs had from 13 to 10 days; and Dulwich had the distinction of having only one. Fogs were least frequent on Mondays (87 occasions), and most frequent on Fridays (163 occasions), and the hours of greatest density were from 6 a.m. to noon. The density of fog was not found to diminish appreciably with height above the ground, and the appearance of fog was very often simultaneous over the area, while in no case did fog drift up the estuary into London. Fogs never appeared in cyclonic conditions, but 33 out of 52 observed cases were formed during anticyclonic weather. No severe fogs occurred when the air temperature was above 40°.

The result of the inquiry is to satisfy Captain Carpenter that something might be done to predict fogs if the records of thermographs in all parts of London could be compared, and readings obtained from thermometers suspended over London from balloons.

RAINFALL AND TEMPERATURE, APRIL, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·14	+ ·62	·44	26*a*	13	61·1	29	27·8	18	9	1
II.		Tenterden	2·20	+ ·43	1·05	26	13	60·0	30	26·0	17	8	1
,,		Hartley Wintney	1·81	+ ·17	·55	28	12	59·0	28*c*	25·0	19*e*	17	1
III.		Hitchin	1·55	+ ·03	·33	28	14	58·0	29	26·0	17*f*	12	..
,,		Winslow (Addington)	1·48	— ·08	·40	28	12	60·0	25	23·0	19	12	1
IV.		Bury St. Edmunds (Westley)	1·96	+ ·43	·30	1	15	60·0	28	26·0	16*g*	..	..
,,		Norwich (Brundall)	2·52	+ 1·01	·35	1	22	60·0	29*b*	28·6	20	7	1
V.		Winterborne Steepleton	4·31	...	1·14	25	11	56·2	8	25·0	18	10	1
,,		Torquay	1·34	...	·33	29*b*	9	57·8	11	32·0	17	1	
,,		Polapit Tamar [Launceston]..	2·23	+ ·07	·53	30	16	57·1	9	23·8	18	8	
VI.		Stroud (Upfield)	2·30	+ ·46	·80	28	13	60·0	28*d*	29·0	13*h*	7	..
,,		Church Stretton (Woolstaston)	1·47	— ·41	·60	28	13	62·5	28	21·0	18	9	..
,,		Worcester (Diglis Lock)	1·78	+ ·35	·56	28	13	...	...	...	...	...	..
VII.		Boston	1·74	+ ·36	·44	30	12	61·0	28	25·0	16	10	..
,,		Hesley Hall [Tickhill].....	1·29	— ·05	·64	30	12	60·0	28	26·0	23	12	..
,,		Derby (Midland Railway).....	1·90	+ ·35	·60	30	15	61·0	30	27·0	18*i*	11	..
VIII.		Bolton (The Park).....	2·30	+ ·11	·43	3, 14	17	56·2	28	27·3	18	9	..
IX.		Wetherby (Ribston Hall) ...	1·43	— ·31	·30	30	14	...	...	...	...	...	..
,,		Arncliffe Vicarage.....	3·26	— ·10	1·20	3	15	...	...	...	...	...	..
,,		Hull (Pearson Park).	1·99	+ ·40	·42	30	17	60·0	28	26·0	13	11	1
X.		Newcastle (Town Moor)	1·44	— ·22	·40	14	15	...	...	...	...	...	..
,,		Borrowdale (Seathwaite).....	4·81	— 1·53	2·00	3	17	56·3	8, 28	25·4	18	9	..
XI.	WALES.	Cardiff (Ely).....	2·32	+ ·14	·84	25	15	...	...	...	...	...	..
,,		Haverfordwest	2·91	+ ·49	1·10	25	14	59·3	10	27·3	18	7	1
,,		Aberystwith (Gogerddan) ...	2·99	+ ·42	·75	25	12	65·0	28	20·0	15*j*	13	..
,,		Llandudno.....	1·28	— ·50	·36	30	12	56·0	10*d*	31·0	18	1	..
XII.	SCOTLAND.	Cargen [Dumfries]	1·53	— ·80	·83	29	6	58·0	8	24·0	18	14	..
XIII.		Edinburgh (Royal Observatory)	1·06	...	·29	29	14	54·0	8	26·5	15	10	1
XIV.		Colmonell	1·10	— 1·07	·45	3	7	60·0	30	25·0	23	10	..
XV.		Tighnabruaich	2·48	...	·83	3	12	57·0	30	28·0	12*k*	9	..
,,		Mull (Quinish).....	2·35	— ·44	·72	3	17	...	...	...	...	...	..
XVI.		Loch Leven Sluices	1·29	— ·70	·36	28*b*	8	...	...	...	...	...	..
,,		Dundee (Eastern Necropolis)	1·00	— ·54	·45	27	11	58·9	8	28·1	17	14	..
XVII.		Braemar	2·29	+ ·20	·51	27	22	53·8	30	23·0	24	18	2
,,		Aberdeen (Cranford)	2·14	+ ·30	·21	14	24	58·0	6	28·0	16*h*	13	..
,,		Cawdor (Budgate)	1·40	— ·17	·23	11	20	...	...	...	...	...	..
XVIII		Strathconan [Beauly]	...	...	...	...	...	...	...	...	...	...	..
,,		Glencarron Lodge.....	7·14	+ 2·48	1·06	5	18	57·9	25	22·6	16	14	..
XIX.		Dunrobin	2·69	+ ·92	·50	6	18	59·0	9	30·0	14*g*	8	..
,,		S. Ronaldshay (Roeberry) ...	2·45	+ ·53	·29	20	22	51·0	30	25·0	16	11	..
XX.	IRELAND.	Darrynane Abbey.....	2·14	— 1·36	·42	25	17	...	...	32·0	13	1	..
,,		Waterford (Brook Lodge) ...	1·40	— 1·22	·62	28	11	59·0	8	26·0	14	7	..
,,		Broadford (Hurdlestown) ...	1·84	— 0·24	·61	28	17	...	...	...	...	...	..
XXI.		Carlow (Browne's Hill)	1·87	— ·42	·46	25	12	...	...	...	...	...	..
,,		Dublin (FitzWilliam Square)	1·05	— ·92	·34	25	17	61·1	6	29·9	17	4	
XII.		Ballinasloe	1·44	— ·85	·23	3	18	62·0	30	25·0	17	12	..
,,		Clifden (Kylemore)	3·44	— 1·83	·66	5	12	...	...	...	...	...	..
XIII		Seaforde.....	1·37	— 1·06	·35	14	14	64·0	27	25·0	17	14	1
,,		Londonderry (Creggan Res.).	2·14	— ·32	·47	14	19	...	...	...	...	...	..
,,		Omagh (Edenfel)	2·40	+ ·04	·45	14	17	59·0	30	26·0	17	9	1

+ Shows that the fall was above the average ; — that it was below it.

a and 28. *b* and 30. *c* and 29. *d* and 29, 30. *e* and 20. *f* and 22. *g* and 18. *h* and 17. *i* and 19, 20. *j* and 16, 17, 18, 19. *k* and 14.

SUPPLEMENTARY RAINFALL, APRIL, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	2·28	XI.	Llandefaelog-fach.....	2·24
II.	Dorking, Abinger Hall .	2·60	,,	New Radnor, Ednol.....	2·91
,,	Sheppey, Leysdown	1·74	,,	Rhayader, Nantgwillt...	2·69
,,	Hailsham	1·98	,,	Lake Vyrnwy	2·22
,,	Crowborough.....	2·81	,,	Ruthin, Plâs Drâw	1·85
,,	Ryde, Beldornie Tower..	2·44	,,	Criccieth, Talarvor	2·05
,,	Bournemouth, Kempsey	3·00	,,	I. of Anglesey, Lligwy..	1·75
,,	Emsworth, Redlands ...	2·72	,,	Douglas, Woodville.....	1·83
,,	Alton, Ashdell	2·54	XII.	Stoneykirk, Ardwell Ho.	1·28
,,	Newbury, Welford Park	3·06	,,	Dalry, Old Garroch	2·32
III.	Oxford, Magdalen Coll..	2·13	,,	Moniaive, Maxwelton Ho.	1·33
,,	Banbury, Bloxham	1·96	,,	Lilliesleaf, Riddell	1·57
,,	Pitsford, Sedgebrook ...	1·76	XIII.	N. Esk Res. [Penicuick]	1·50
,,	Huntingdon, Brampton.	1·35	XIV.	Dalry, Blair	2·30
,,	Wisbech, Bank House...	1·50	,,	Glasgow, Queen's Park..	1·34
IV.	Southend	1·74	XV.	Inveraray, Newtown ...	3·24
,,	Colchester, Lexden	1·88	,,	Ballachulish, Ardsheal...	3·13
,,	Saffron Waldon, Newport	1·74	,,	Campbeltown, Redknowe	1·77
,,	Rendlesham Hall	2·01	,,	Islay, Eallabus.....	2·37
,,	Swaffham	1·92	XVI.	Dollar.....	1·12
V.	Salisbury, Alderbury ...	2·65	,,	Balquhidder, Stronvar...	1·91
,,	Bishop's Cannings	3·23	,,	Coupar Angus Station...	1·31
,,	Ashburton, Druid House	2·22	,,	Blair Atholl	1·11
,,	Okehampton, Oaklands.	1·99	,,	Montrose, Sunnyside ...	1·38
,,	Hartland Abbey	1·80	XVII.	Alford, Lynturk Manse..	3·22
,,	Lynmouth, Rock House	1·84	,,	Keith H.R.S.....	3·08
,,	Probus, Lamellyn	1·91	XVIII.	Fearn, Lower Pitkerrie..	1·98
,,	Wellington, The Avenue	2·16	,,	S. Uist, Askernish	1·62
,,	North Cadbury Rectory	3·57	,,	Invergarry.....	2·39
VI.	Clifton, Pembroke Road	3·25	,,	Aviemore, Alvie Manse.	1·75
,,	Ross, The Graig	2·31	,,	Loch Ness, Drumnadrochit	1·65
,,	Shifnal, Hatton Grange	1·37	XIX.	Invershin	4·07
,,	Wem, Clive Vicarage ...	...	,,	Bettyhill	2·88
,,	Cheadle, The Heath Ho.	2·09	,,	Watten H.R.S.....	2·32
,,	Coventry, Kingswood ...	1·62	XX.	Cork, Wellesley Terrace	1·82
VII.	Market Overton	1·86	,,	Killarney, District Asyl.	2·19
,,	Grantham, Stainby	1·98	,,	Glenam [Clonmel]	1·78
,,	Horncastle, Bucknall ...	1·35	,,	Ballingarry, Hazelfort...	1·56
,,	Worksop, Hodsck Priory	1·12	,,	Miltown Malbay	2·31
VIII.	Neston, Hinderton	1·71	XXI.	Gorey, Courtown House	1·08
,,	Southport, Hesketh Park	1·78	,,	Moynalty, Westland ...	1·55
,,	Chatburn, Middlewood.	2·93	,,	Athlone, Twyford	1·28
,,	Duddon Val., Seathwaite Vic.	3·16	,,	Mullingar, Belvedere ...	1·96
IX.	Langsett Moor, Up. Midhope	2·30	XXII.	Woodlawn	1·68
,,	Baldersby	1·11	,,	Westport, Murrisk Abbey	2·01
,,	Scalby, Silverdale	2·78	,,	Crossmolina, Enniscoe ..	2·43
,,	Ingleby Greenhow Vic..	1·82	,,	Collooney, Markree Obs.	2·27
,,	Middleton, Mickleton ...	1·54	XXIII.	Enniskillen, Portora ...	1·65
X.	Beltingham	1·84	,,	Warrenpoint.....	1·61
,,	Bamburgh	1·50	,,	Banbridge, Milltown ...	·88
,,	Keswick, The Bank.....	1·48	,,	Belfast, Springfield	1·82
,,	Melmerby Rectory	1·33	,,	Bushmills, Dundarave..	1·82
XI.	Llanfrechfa Grange	2·17	,,	Stewartstown	1·32
,,	Treherbert, Tyn-y-waun	3·79	,,	Killybegs	4·09
,,	Castle *Malgwyn*	2·44	,,	Horn Head	2·36

METEOROLOGICAL NOTES ON APRIL, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—Changeable and unsettled, with a period of dry but cold weather in the middle. S falling on 4 days. The mean temp. was 45°·2, or 2°·9 below the average. This was 1°·2 below the mean temp. of March, 1903, and only 0°·1 above that of February.

TENTERDEN.—The middle of the month was very cold and dry, with strong N. winds. S on 16th and ice over ¼ inch thick on 17th. Sunshine 165 hours.

CROWBOROUGH.—The chief feature was the unseasonable cold period which lasted from 12th to 25th, with mean temp. of 39°·7.

HARTLEY WINTNEY.—The period of cold weather from 9th to 26th, with N. wind, grass frost each night and occasional showers of sleet, has never been equalled. Ozone on 25 days with a mean of 5·0.

PITSFORD, SEDGEBROOK.—Very cold with bitter northerly winds during the day time and sharp frosts at night. Fruit much damaged. S on 12th and 13th.

COLCHESTER, LEXDEN.—Cold till 25th especially from 11th to 21st, when N. wind prevailed with occasional S, seriously checking the forward vegetation.

WINTERBORNE STEEPLETON.—Mean temp. 2°·9 below the average of 10 years, and less than in any year in that period. The R was greater than in any April except 1897.

TORQUAY, CARY GREEN.—R 1·07 in. below the average. Mean temp. 47°·1, or 0°·8 below the average. Duration of sunshine 180·6 hours, or 0·4 hours above the average. Mean amount of ozone 5·2; max. 8·5 on 5th with W.S.W. wind; min. 3·0 on 28th with S.S.W. wind.

WELLINGTON, THE AVENUE.—Very low temp., especially from about 12th to 24th, with S night frosts in the screen, the same number as in January.

NORTH CADBURY RECTORY.—The coldest April in 7 years after the warmest March. In spite of 5 warm nights at the end, the average min. in shade and on grass was lower than any of the winter months.

CLIFTON, PEMBROKE ROAD.—Mostly dry and cold, with frequent night frosts till 25th, when a change occurred, with 34 hours R. Remainder mild and rainy; 3·00 in. of R fell in the last 6 days.

ROSS, THE GRAIG.—Another extraordinary month, just the reverse of last. The first 11 days, except 3rd, were warm and fine. Vegetation very forward. From 12th to 25th every day was below the average temp. with severe frosts. No such April remembered except 1837 and possibly 1847.

BOLTON, THE PARK.—Cold period from 9th to 19th, but by no means without precedent. Mean temp. 41°·1, or 3°·1 below the average. Duration of sunshine 125¼ hours, on 24 days, being 14½ hours above the average.

HULL, PEARSON PARK.—Very unsettled, with heavy showers. Frequently very cold and unpleasant. H on 6 days. An inch and a half of S on 16th.

WALES AND THE ISLANDS.

HAVERFORDWEST.—From 11th to 24th the weather was very severe, the unequalled cold spell being preceded and followed by wet mild weather.

DOUGLAS, WOODVILLE.—The beginning was very cold and unseasonable with biting N.W. and W. winds and gales, such as characterised the preceding months. From 11th to 19th was intensely cold with frost and S. Easter Monday had a temp. 10° below that of Boxing Day. Vegetation backward.

SCOTLAND.

CARGEN [DUMFRIES].—The mean temp., 42°·2, although only slightly below that of 43 years, was lower than that of the two preceding months. Notwithstanding the previous heavy R the neighbourhood suffered severely from the

dry weather, until the end of the month. Frost between 20th and 25th with cold winds and considerable sunshine, caused great destruction among early vegetables. T and L on 30th.

LILLIESLEAF, RIDDELL.—From 11th to 26th N.E. wind prevailed, with night frosts, doing a little damage to fruit. Very heavy TS on 30th at about 3 p.m., for half an hour, with ·18 in. of R.

TIGHNABRUAICH.—April, if dry, was cold and wintry. On 14th there was 2½ inches of S, succeeded for several days by sharp frost, doing considerable damage to fruit blossom and garden plants.

COUPAR ANGUS.—The first month since October with deficient R, the total being ·39 in. below the average. A long spell of low temp. from 11th to 26th had a mean nearly 5°·0 below the average for April.

LYNTURK MANSE.—S fell on 11 days.

DRUMNADROCHIT.—The dull and wet first half coming after the heavy R of the previous three months, kept the ground water-logged, and spring operations have rarely been so far behind.

IRELAND.

CORK, WELLESLEY TERRACE.—R 1·06 in. below the average, but for the past 4 months an excess of 5·79 in. Mean temp. was the lowest in April for 20 years.

DUBLIN, FITZWILLIAM SQUARE.—Mean temp. 45°·9, or 1°·7 below the average, and only 0°·3 warmer than March. Polar winds predominated. Mean temp. for the week 12th to 18th, was 39°·5. High winds occurred on 7 days, reaching the force of a gale on 7th only. Fog on 4 days. L on 30th.

BELFAST, SPRINGFIELD.—Warm and pleasant, except for brief S and H showers from 12th to 14th. Distinctly a boon to farmers.

OMAGH, EDENFEL.—Although the R was but little over the average, the saturation of the soil from the extraordinary R of the first quarter continued to delay farming operations, and the unusual cold of the middle week seriously checked vegetation. Better conditions, however, prevailed at the close. Martins appeared on 10th and swallows on 19th, but did not remain.

THE FOUR MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—April, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	+1·26	120	Arncliffe	+13·23	167	Braemar	+10·79	211
Tenterden	+ ·84	112	Hull	+ ·74	111	Aberdeen	+2·34	126
Hartley Wintney	+2·95	144	Newcastle	— ·41	94	Cawdor	+4·56	157
Hitchin	+2·19	136	Seathwaite	+22·45	151	Glencarron	+16·83	157
Winslow	+1·59	125	Cardiff	+5·04	145	Dunrobin	+2·56	128
Westley	— ·13	98	Haverfordwest	+5·43	141	Darrynane	+1·95	112
Brundall	— ·04	99	Gogerddan	+5·10	140	Waterford	+4·57	140
Alderbury	+3·43	143	Llandudno	+5·26	164	Broadford	+4·85	150
Ashburton	+5·61	134	Dumfries	+10·00	173	Carlow	+5·61	155
Polapit Tamar	+5·45	153	Lilliesleaf	+7·26	184	Dublin	+2·29	129
Stroud	+3·31	143	Colmonell	+3·59	126	Mullingar	+8·62	183
Woolstaston	+3·10	138	Glasgow	+13·22	226	Ballinasloe	+6·48	161
Boston	+1·08	120	Inveraray	+12·84	155	Clifden	+5·67	123
Hesley Hall	+ ·90	116	Islay	+6·81	149	Crossmolina	+8·59	152
Derby	+2·46	141	Mull	+7·15	141	Seaforde	+3·91	135
Bolton	+2·99	129	Loch Leven	+11·36	207	Londonderry	+3·97	135
Wetherby	+2·87	144	Dundee	+2·37	129	Omagh	+8·57	178

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1902.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	59·2	6	26·7	21	50·0	40·0	41·7	91	83·6	22·2	1·80	11	6·9
Malta	78·0	2	47·8	24	67·2	55·5	53·0	78	124·5	41·9	7·02	10	3·5
Lagos, W. Africa	90·1	18*a*	75·1	var.	86·5	77·5	75·2	77	148·0	...	·16	1	...
Cape Town	89·7	23	47·7	18	70·3	53·0	51·1	67	...	...	·85	7	3·6
Durban, Natal	92·3	20	57·1	11	79·6	62·2	...	...	143·3	...	5·15	19	6·3
Mauritius	89·9	20	59·3	4	86·4	67·7	65·6	69	152·7	51·8	1·32	7	5·3
Calcutta	88·1	3	56·9	26	82·5	63·4	62·2	69	152·9	51·2	·05	1	1·4
Bombay	91·4	8	72·6	30	88·6	75·8	68·6	66	139·8	61·9	·01	1	1·8
Madras	88·9	7	69·6	12	84·2	74·0	72·1	83	139·0	66·8	10·51	17	6·0
Kodaikanal	67·1	24	47·2	30	61·5	50·5	51·6	89	135·2	36·4	9·38	16	6·5
Colombo, Ceylon	90·7	28	71·5	6	87·4	74·0	73·2	83	152·0	70·2	20·10	24	7·4
Hongkong	80·1	21	62·8	25	75·9	67·6	63·0	74	131·6	...	5·40	13	5·5
Melbourne	101·4	25	45·0	29	76·8	53·7	49·5	59	155·2	35·8	·98	7	5·8
Adelaide	101·8	3	47·5	21	83·6	59·7	49·1	45	159·3	42·5	·56	6	4·1
Coolgardie	106·2	23	46·2	27	84·1	55·2	...	...	171·6	...	·97	3	3·1
Sydney	95·0	7	56·8	1	76·4	63·0	58·6	67	139·0	47·0	2·80	18	5·4
Wellington	69·0	7, 9	38·0	25	61·6	47·6	46·1	74	129·0	30·0	2·96	15	6·3
Auckland	72·5	23	48·0	5	64·4	52·2	44·7	60	136·0	45·0	·88	12	5·2
Jamaica, Negril Point	90·4	17	68·3	24	86·5	71·7	71·6	78	...	...	2·22	6	...
Trinidad	93·0	29*b*	68·0	22*c*	88·9	71·1	76·3	88	162·0	66·0	2·74	11	...
Grenada	87·6	7	72·6	19	84·0	74·8	71·7	76	155·0	...	7·85	22	2·6
Toronto	65·1	12	16·2	29	50·3	35·5	39·1	82	78·2	11·2	1·70	12	7·1
Fredericton, N.B.	56·8	2	13·8	26	43·6	26·4	26·8	65	...	...	1·64	8	6·7
Winnipeg	57·0	2	— 7·0	26	35·3	16·7	...	...	...	...	1·02	5	6·4
Victoria, B.C.	54·9	10	33·4	29	48·1	41·1	41·0	88	...	...	6·15	24	8·2
Dawson	20·4	1	—48·0	28	—0·9	—11·2	...	...	...	...	1·10	4	4·4

a—and 20, 21. *b*—and 30. *c*—and 28.

MALTA.—Mean temp. of air 60°·4, or 1°·9, below average. Mean hourly velocity of wind 9·5 miles or 0·1 above average. Mean temp. of sea 66°·4. J. F. DOBSON.

Mauritius.—Mean temp. of air 1°·3, dew point 1°·5 above, and rainfall ·57 in., and mean hourly velocity of wind 1·8 miles below, averages. L and T on 25th. T. F. CLAXTON.

MADRAS.—Sunshine 107·3 hours, or 31·2 per cent. of possible. R. D. JONES.

KODAIKANAL.—Mean temp. of air 54°·6. Sunshine 73·9 hours. *pro* C. MICHIE SMITH.

COLOMBO.—Mean temp. of air 79°·9 or 0°·1 above, of dew point 0°·9 above, and R 7·33 in. above, averages. Mean hourly velocity of wind 5·7 miles; prevailing direction N., N.E. and N.W. TS8 on 24 days, causing numerous casualties. In one case several persons were knocked down by a return flash. Close to the spot where they were standing a small fissure over 6 feet deep and very narrow was found, the ground having been disturbed all round in a circle 10 inches in diameter and 9 inches deep.
H. O. BARNARD.

HONGKONG.—Mean temp. 71°·5 or 2°·3 above, sunshine 150·8 or 45 hours below, R 4·23 in. above, their respective averages. Mean hourly velocity of wind 11·4 miles; prevailing direction E.N.E. F. G. FIGG.

Adelaide.—Mean temp. 71°·6; highest on record for November in 46 years, being 4°·5 above average. R ·42 in. below average. C. TODD, F.R.S.

Auckland.—Mean temp. 2° below the average and R not one-third of the average. *An unusually cool and dry November.* T. F. CHEESEMAN.

SYMONS'S
METEOROLOGICAL MAGAZINE.

No. CCCCXLIX.] JUNE, 1903. VOL. XXXVIII.

METEOROLOGICAL EXHIBITION AT SOUTHPORT.

WE have pleasure in calling the attention of our readers to the following circular which has recently been issued, and to which it is hoped there will be a hearty response.

METEOROLOGICAL OFFICE, S.W., *May 19th*, 1903.

DEAR SIR,—In connection with the meeting of the International Meteorological Committee, at Southport, during the session of the British Association in September next, it is proposed to make arrangements for an Exhibition of Meteorological appliances and other objects of Meteorological interest.

Upon the initiative of the Meteorological Council, with the co-operation of the Royal Meteorological Society and the Scottish Meteorological Society, who have appointed representative members, a Committee has been formed to carry out this proposal.

In order to divide the work of collection and organisation it is proposed to group the exhibits into four classes; those who are willing to co-operate are requested to communicate at once with the gentlemen named below, who have kindly undertaken to receive, on behalf of the Committee, intimations and suggestions as to objects of meteorological interest proposed for exhibition.

A. Meteorological Statistics Dr. H. R. Mill, 62, Camden Square, N.W.

B. Weather Telegraphy ... Mr. W. N. Shaw, 63, Victoria Street, S.W.

C. Atmospheric Physics ... Capt. Wilson-Barker, H.M.S. Worcester, Greenhithe, Kent.

including (*a*) Meteorological Photography; (*b*) Instruments, and Instrumental records; (*c*) High Level Stations, Balloons and Kites; observations and records; (*d*) Experimental illustrations.

D. The relation of Meteorology to other branches of Physics Mr. A. R. Hinks, The Observatory, Cambridge.

The opportunities for a gathering of the meteorologists of other countries in the United Kingdom have been comparatively rare. The committee invite workers in meteorology and allied branches of physics to co-operate on this occasion in the formation of an Exhibition which shall adequately represent the position of this country with regard to the prosecution of those sciences.

The Meteorological Council have sanctioned a proposal to have a selection of the official telegraphic reports repeated daily to Southport during the meeting, to be charted and dealt with by a member of the staff of the Office in connection with the Exhibition.

I am, dear sir, yours faithfully, W. N. SHAW.

Correspondence.

THE THUNDERSTORMS OF MAY 30TH AND 31ST.

To the Editor of Symons's Meteorological Magazine.

PERHAPS some few particulars of the violent storms that occurred here last Saturday will be welcome. When I got back from London, at 3.30 p.m., and was in this road, I noticed thunder clouds (cumulo-nimbus) to the N.W., N.E. and S.W. of this house. The N.W. storm seemed to pass away, but the N.E. and S.W. storms seemed to coalesce just over this house. The rain, and hail, and lightning began at 4.10 p.m., the thunder having been heard since 3.30 p.m. At 4.26 p.m. there was a terrific flash of lightning, followed instantly by a violent peal of thunder. This flash, it afterwards appeared, struck two houses in this road, doing damage to the roofs and chimney, and also one in the Manor Road, close by, breaking a window and burning the frame, and doing damage to a chimney. From 4.10 to 5.10 the rain and hail came down in torrents, practically sweeping the paths of all mud and sand. At 5.10 the rain began to abate, and at 5.15 only a very few drops were falling; so I measured the water in the gauge and found 2·77 in., all of which fell in 1 hr. 5 min. A few drops were still falling, and it came on again much heavier with hail, and thunder, and lightning. At 6.20 the rain ceased, so I measured the gauge again, and found ·25 in. in 1 hr. 5 mins., making a total of 3·02 in. in 2 hrs. 10 mins. It continued fine till midnight, when another storm came up from the S.E. This storm, with lightning and thunder, lasted till 3 a.m. on the 31st. The rain beginning at 2 a.m., lasted, as near as I can make out, an hour. When measured at 9 a.m. there was ·11 in.; making a total of 3·13 in. Under the railway bridge, where the rain always collects, there must have been over 3 feet of water, for it reached the point of the collar of our milkman's pony. There was 2 ft. 9 in. of water in my greenhouse. My next door neighbour, who had lived over nine years in Ceylon, had never before seen such rain. The damage to our roads is estimated at over £1,000. One of the largest hailstones measured ¾ in. in diameter. I have the following returns for the 30th exceeding 1·00 in.: Beddington Corner, 3·67 in. (3·50 in. fell in just under one hour); Wallington, 3·13 in. as stated above; Beddington, 2.29 in. (2·10 in. fell between 4.15 and 6 p.m.); Wimbledon Sewage Works, 2·26 in. (1·58 in. fell between 4.10 and 5.30 p.m.); Duppas House, Croydon, 1·85 fell in 2·84 hours (·80 in. fell in 15 minutes); Waddon New Road, Croydon, 1·85 in. (1·75 in. fell between 4.30 and 6.15 p.m.); Richmond, 1·34 in.; Brimstone Barn, Croydon, 1·32 in.; Park Hill Rise, Croydon, 1·32 in.; and Morden, 1·15 in.

F. CAMPBELL BAYARD.

Cotswold, Wallington, Surrey, 8th June, 1903.

On May 28th a sharp thunderstorm passed over this district (East Surrey) between 11.20 a.m. and noon, the lightning being very vivid and the thunder following without any appreciable interval.

On the 30th, after a "close," though fine, forenoon (shade temperature 75°), a heavy thunderstorm approached from the westward shortly after 3 p.m., and from 4.5 to 4.48 p.m. lightning and thunder were incessant, not a drop of rain falling the while. The "time interval" varied from two or three seconds to a negligible quantity. Between 5.8 and 6.15 p.m. rain descended fairly heavily, 0·49 in. being found in the gauge at the latter time. Hail fell with great force for a very short period.

On the 31st, at 2 a.m., an even more violent storm occurred, it being impossible to count the time interval from that hour to 2.30 a.m., on account of the continual illumination of the sky by lightning and the incessant rumble of thunder. A tree was "scorched" in the garden here. The rainfall during this storm amounted to 0·24 in., which practically all descended in ten minutes, 2.30—2.40 a.m.

I should not venture to trespass upon your space with these notes, were it not for the fact that a succession of thunderstorms of such a violent character is very unusual in this neighbourhood.

D. W. HORNER.

Clapham Park, S.W., June 8th, 1903.

A terrific thunderstorm visited this locality on the 30th to 31st of May. Time taken by marine chronometer checked by regulator, both of known rate, 11.55 p.m. 30th, to 2 a.m. 31st, G.M.T. Lightning and thunder almost continuous. Severe vibration of doors and windows. Lightning at times apparently going up from the ground. I thought I saw globular lightning, but am probably mistaken, as this is of course very rare. The rainfall was ·60 in. Intense heat was experienced both on the 30th and 31st. Slight thunderstorms followed on June 1st, 6.10 p.m., and 8.10 a.m. June 2nd; the rainfall of which together was ·29 in.

F. H. PHILLIPS, F.R.Met.Soc.

Burgess Hill, Sussex, 2nd June, 1903.

In case you wish for any details of the great storms of Saturday and Sunday last, I may mention that thunder began about 2 p.m. Rain began at 4 p.m., and was very heavy until 5.30, ceasing about 6 p.m. The lightning and thunder were very nearly simultaneous about 4.30 to 5 p.m. Another storm came on about 2 a.m. on the 31st, with sharp but short rain. Total rain, measured 9 a.m. of 31st, 1·06 in., of which about ·90 in. fell in the first storm, ·16 in the second.

G. SEARLE.

30, Edith Road, West Kensington, June 2nd, 1903.

[At Camden Square the thunderstorms were characterised by brilliant lightning and loud long-continued reverberations of thunder, especially on the early morning of the 31st. The remarkable feature was the absence of rain, only ·05 in. being recorded in the twenty-four hours, of which ·025 in. fell between 5.30 and 6.45 p.m. on the 30th, after the first storm, and ·025 in. between 2.30 and 3.20 a.m. on the 31st.

The extremely local nature of the rainfall is well brought out by the letters of our correspondents. We had hoped to discuss the rainfall of May in some detail, as the distribution is remarkable in several ways, but for some cause, which we can only surmise to be the unusual date of the Whitsuntide holidays, so many of our most faithful monthly observers have failed to send in their reports in time, that the intention has to remain unfulfilled.—ED. *.SM.M.*]

SYSTEMATIC CLOUD PHOTOGRAPHY.

To the Editor of Symons's Meteorological Magazine.

A GOOD deal is being done now towards the study of cloud forms by means of photography, but, so far as I know, at no station are photographs of the face of the sky taken regularly as part of the daily observations. One reason for this may be that on many days it is not possible to take any photographs, but I venture to think that for forecasting purposes, or at any rate, as part of the records of the station, photographs taken daily as often as practicable would be of value.

It is difficult by any description to give an accurate impression of the state of the sky as regards cloud forms, and in the hands of a skilled observer the camera should be able to afford useful and exact information.

I do not know whether the Rev. S. Barber has photographed the cirrus cloud form which he has described in his letter in the February number headed "On some Precursors of Weather Change," and which he has several times found to precede fine weather; such a photograph would be valuable, and if it be found that certain types or sequences of types of cloud go before or accompany certain phases of weather something will have been gained. For this purpose the series of daily photographs should be compared with the published weather maps.

FRANCIS DRUCE.

65, Cadogan Square, S.W., May 3rd, 1903.

THE ORIGIN OF CYCLONE HEAT.

BY L. C. W. BONACINA.

IN endeavouring to ascertain the precise causes of the observed development and distribution of cyclone heat, we have obviously to deal with the combined thermal effect of a number of different temperature factors. Evidently, then, we must first of all strive to

disassociate these factors, in order that, when we consider more particularly the effect due to one of them, we may be able to detect, and make proper allowance for, the influence of each of the others. In the present article we propose to discuss solely the cyclones of North-Western Europe, for although the broad features of these low pressure systems* are the same all over the world, there are so many minor peculiarities distinguishing between British storms and those of the tropics, that the laws controlling their energy and movements are not the same in the several climatic zones.

We may classify the chief agents which exert a more or less direct influence upon the temperature of the lower air in a cyclonic disturbance under the following heads: (*a*) radiation, solar or terrestrial, (*b*) the physical conditions of that portion of the Earth's surface which the cyclone is traversing, (*c*) the direction of the wind, (*d*) the condensation of vapour into clouds and rain, (*e*) the peculiar properties of cyclone action itself. The influence of radiation need not concern us much in our investigation into the origin of cyclone heat, provided, of course, that we are always mindful of its existence, so as to be able to judge to what extent a given degree of heat or cold may be due to its operation. Every one, of course, knows that the high temperature experienced in the front of a cyclone is not the result of direct solar radiation, inasmuch as the sky is almost invariably thickly overcast. Moreover, in these latitudes the altitude of the midwinter sun is so low that the direct rays, even when freely transmitted through the atmosphere, do not appreciably warm that portion of it in contact with the soil, as we know from the fact that in frosty anti-cyclonic weather the mid-day shade temperature frequently remains below the freezing point, though the ground may be free from snow.

It is quite conceivable that a body of warm water such as, for instance, the Gulf Stream, should be capable of effecting a very considerable rise of temperature in any mass of air that may happen to be crossing its track. Now, knowing that the specific gravity of air as compared with water is $\frac{1}{773}$, and the specific heat ·2375 (Cp.) we can easily calculate that one cubic metre of water cooling 1 degree suffices to raise 773 cubic metres of air 4·2 degrees in temperature, or, in a more general form, x cubic metres of water in cooling t degrees emit enough heat to raise the temperature of $773x$ cubic metres of air $\frac{t}{4\cdot2}$ degrees. Hence we see how potent must be the influence of a stream of warm water, like the Gulf Stream, in heating the super-incumbent air. Now we most readily allow that when, as often happens, a westerly or south-westerly current of air blows straight across these islands from off the

* We must be careful to use the word "cyclone" in the meteorological and not in the popular sense. Tornadoes, waterspouts and storms of that class, which are usually styled "cyclones" are of a totally different nature, and are not influenced by the Earth's axial rotation.

Atlantic, a fairly uniform distribution of high temperature will be experienced, due to the convection of thermal energy from the waters of that ocean river. We are not entitled, however, to assume, as is frequently done in text books of physical geography, that the high temperatures associated with the wet and stormy weather of winter cyclones, are mainly due to the fact that storm systems usually cross the Gulf Stream before they reach us; for we have every reason to believe that the motion of propagation of a cyclone is of the nature of a wave, and that the wind is not moved forward by the system in its progress, the atmospheric disturbance always affecting fresh masses of air. Thus the winds revolving around the baric minimum do not partake of the motion of translation of the depression, but as the low pressure area advances fresh draughts of air are continually drawn in, which, in turn, are speedily left behind. Such facts as these are sufficient to warrant the belief that the direct influence of the Gulf Stream is imperceptible during the passage of a cyclonic disturbance across these islands.

It may be taken as a general rule that a south-westerly wind blowing across Great Britain from a considerable distance, will tend to deflect the isotherms north-eastwards, while conversely, a north-easterly draught of air flowing over the country from the Arctic regions, will tend to drive them south-westwards, and doubtless, the relative distribution of heat and cold is in large measure determined by this element; but it cannot be denied that the effect is greatly over-estimated. That the high temperature of a cyclone front is not altogether due to the southerly direction of the wind is proved by the fact that, when, as rarely happens, a depression moves westwards, the greatest development of heat occurs with northerly winds, which then blow in front of it; in addition to this we have the fact that the easterly winds of the northern half of an ordinary eastward moving cyclone, are characterized by the same quality of heat as the westerly winds of the southern half, though in a less marked degree. Since, however, the influence of the direction of the wind upon the temperature of the air in a cyclone will depend largely upon the shape, size and intensity of the system, as well as on the surrounding distribution of pressure and temperature, we ought not to state too definitely what the normal effect may be. Suffice it to say, that the magnitude of this influence is a considerable, though very variable quantity, being essentially dependent upon the temperature of the region from which the wind is blowing.

The latent heat liberated by the condensation of moisture into clouds and rain owing to the ascending motion of the atmosphere, is often urged as the primary cause of the excessively high temperatures observed in cyclone fronts; but this can only be influential in retarding the cooling of the ascending masses of air, or in checking the formation of frost, and would certainly be incompetent to produce the great increase of temperature

from near the freezing point to well over 50° F., such as constantly marks the passage of a deep cyclonic disturbance across Great Britain in winter time. Moreover, Abercromby has shown that, though the greatest development of both damp and heat is usually associated with the right front quadrant of a depression, there is no mutual relationship between the height of the thermometer and the amount of rainfall, inasmuch as the heaviest precipitation sometimes occurs in the rear of the trough, after temperature has commenced to fall. The true explanation of cyclone heat would seem to be that afforded by Abercromby in 1875, who suggested that the air in the front portion of a cyclone underwent a compression, adequate to produce the observed high temperature. He took the analogous case of a leaf swirl and called attention to the fact that the leaves were most densely packed together on that side of the swirl where the motions of rotation and translation coincided.

The present writer, however, is disposed to think that the thermal energy evolved in a cyclonic eddy is not merely the result of simple compression, but is also due to internal friction or viscosity consequent upon the enormous shearing stress to which the revolving particles of air must be subjected, part of the energy of this shearing being ultimately dissipated as heat. That there is great aërial compression will be evident when we consider the precise nature of cyclonic circulation. In the first place we know that in a cyclone the air moves spirally inwards towards the centre, in a direction, in this hemisphere opposite to that of the hands of a watch. We also know that the air does not flow directly into the centre, but tends more and more in virtue of centrifugal force exerted upon it, to keep away therefrom, thus increasing the barometric gradient.

The velocity of the wind, *cæteris paribus*, increases as the distance from the central area is diminished, and the centrifugal force then increases as the square root of the cube of the increase of velocity. The result must be obvious to anyone possessed of the true conception of the nature of a cyclone whirl. If there be a constant influx of air into the cyclonic vortex, and if this very air, as it draws near the central calm area, tends as a body to keep away from it, flowing into it only very gradually, the whole whirling mass must undergo great compression, sufficient to produce important thermal effects.

Passing from these theoretical considerations to the observed facts, we find that the greatest inflow of wind, as well as the steepest gradients, occurs in the right front quadrant of a cyclone, the very region which is characterized by the highest temperatures. The justice of these remarks will, we think, be acknowledged by all those who make a systematic study of synoptic charts. It is a noteworthy fact, moreover, that a depression of temperature almost invariably accompanies the rear of a cyclone, where the wind blows nearly parallel to the isobars, being frequently even a little out-curved, instead of in-curved, as in the front. There will thus be no abnormal development of heat due to compression in the rear portion;

in fact, the tendency will not uncommonly be towards a rarefaction of the air, and in this way we may account for the unusual reduction of temperature, occasionally experienced after the barometer has begun to rise along the line of the trough. The inference, then, that we draw from these considerations is, that the air in the front of a cyclone is dynamically warmed by a compression and agitation of its particles, consequent upon the action of centrifugal force at the centre, with a concomitant force, due to the steepness of the barometric gradients, causing air to be sucked into the vortex from all points at the outskirts.

In conclusion, we would observe that we are not justified in expecting to be able to detect any indication of compression upon an isobaric chart. We are only entitled to assert that pressure increases far more rapidly and irregularly outwards from the centre than it would do if compression effects were absent; in other words, if we could conceive of a cyclone characterised by the action of no centrifugal force and consequent compression, both the depth and intensity of the system would be diminished, that is to say, the centre baric minimum would be higher, and the barometric gradients less steep and irregular than those actually observed.

ROYAL METEOROLOGICAL SOCIETY.

THE first of the afternoon meetings of the present session was held at the Society's Rooms, 70, Victoria Street, Westminster, on May 20th, Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

Lieut. C. St.B. Sladen, R.E., was elected a Fellow of the Society.

Mr. C. P. Hooker read a paper on "The relation of the Rainfall to the depth of water in a Well," in which he gave the weekly measurements of the depth of water in a well 101 feet deep at Further Barton, Cirencester, compared with the weekly rainfall for the 16 years 1887-1902. The author's conclusions are as follows:—

The depth of water in the well depends on how much rain penetrates the soil, and this is determined by the amount of rain, the rapidity of its fall, and the existing condition of the soil, which in turn depends on the frequency of the falls of rain and the amount of evaporation. Therefore winter rains penetrate easily, summer rains with difficulty; but summer rains, especially when accompanied by lessened evaporation, tend to moisten the soil, and the water-level does not fall so rapidly. Evaporation has but little effect till April or May; but from that time until the end of September the evaporation is almost as great as the rainfall, and sometimes even greater. However heavy the winter rains are, and however full the well becomes in consequence, it by no means precludes the possibility of scarcity in the summer or autumn; but should the well be full in March, want is not probable. The well is filled sufficiently every winter, and no amount of extra rain will improve matters; therefore

scarcity in summer or autumn depends on what happens later, and especially in the spring months, when a deficiency of rain and subsequent heat and evaporation are important factors. After the early spring months, but little rain usually penetrates to the well, so that a timely forewarning at that season might prove of great value by enabling the existing supplies to be husbanded at an early period.

Considering how narrow the boundary is between sufficiency and want, and looking to the fact that every year sees further demands made on our water supplies, it is of the utmost importance that attention should be paid to the storage of the surplus winter rains. This might be done by the formation of large hill reservoirs, and doubtless such measures as the re-afforesting of extensive tracts of land would check the rapidity with which the rains reach the rivers, and are so lost.

In the discussion which followed the President, Admiral J. P. Maclear, Mr. Baldwin Latham, Colonel T. English, Dr. H. R. Mill, Mr. Clayton Beadle, Mr. J. Hopkinson, and Mr. R. H. Hooker took part, and Mr. C. P. Hooker replied.

Mr. W. Marriott gave an account of the "Frost of April, 1903." The weather from January 19th to March 31st was very mild, the mean temperature at Greenwich for this period of 72 days being 45°·2, which was 5°·7 above the average. Normal or cooler weather prevailed during the first 11 days of April, but on the 12th (Easter Sunday) an abrupt change took place which continued until the 27th. During this time low temperatures prevailed, accompanied by keen northerly winds and great dryness.

The main features are shown by the following values for the Royal Observatory, Greenwich :—

1903.	Jan. 19th-March 31st.	April.	April 12th-25th.
	°	°	°
Temperature—Mean	45·2	44·1	40·8
,, Mean Max. ...	51·2	52·0	49·6
,, Mean Min. ...	39·2	36·7	32·5
Dew Point Temperature	38·9	35·2	29·5
Relative Humidity	79%	71%	64%

Taking England and Wales as a whole there were 10 nights during April on which the temperature fell to 32° or below, 9 of which were between the 12th and 25th. The number of frosts on the grass was very great, there being as many as 23 during the month at Hodsock, and 22 at Bennington and Churchstoke. Snow and hail showers were frequent between the 12th and 17th, especially in the north-east and east of the country. The snow was general over most parts of the Continent, and was so heavy in Denmark and Russia as to stop railway traffic.

One of the special features of the period 12th–25th was the great radiation, the minimum temperature on the grass at several stations being 12° below that in the air, while at Southport the great difference of 16° was recorded on the 17th. Owing to the mildness

of the weather during February and March vegetation was in a very forward condition, and consequently suffered severely from the frost. The destruction of the fruit blossom was great and general.

In the discussion which followed the President, Mr. H. Southall, Mr. Baldwin Latham, Mr. C. Harding, and Mr. D. W. Horner took part, describing the effects of the frost in their respective neighbourhoods.

REVIEW.

Handbook of Climatology. By DR. JULIUS HANN. *Part I., General Climatology.* Translated by ROBERT DE COURCY WARD. New York: The Macmillan Company. London: Macmillan & Co., Ltd., 1903. Size 9 × 6. Pp. xvi. + 438. Price 12s. 6d. net.

PROFESSOR WARD of Harvard has conferred a benefit on the English-speaking world by the publication of Professor Hann's standard treatise on Climatology in an English translation. The translation is so well done and the translator has incorporated so many references to points specially interesting to his readers that the book has a just claim to be treated as an original contribution to science. Like everything emanating from Professor Hann the *Climatology* is characterised by a union of accurate detail and wide grasp of principles, unapproached by any other meteorological writer.

The book under review must not, however, be looked upon as a complete work, for it is the first of three volumes, the two which have not been translated dealing with the more geographical aspect as this one deals with the more meteorological aspect of climatology. The translation of the other volumes Professor Ward found impracticable, and indeed they are so crammed with facts and figures that the language is almost unimportant; any serious student without a special knowledge of German can refer to their pages with a very moderate use of a dictionary. It is different with the general volume, which is adapted for reading as the others are suited for reference; hence our gratitude to Professor Ward.

To some extent the book is edited as well as translated; there are some omissions concerning "matters of special interest to European students only" and some additions which concern the American student mainly. While very fair reference is made to the sources of information as to British climate, readers in this country will miss many illustrations that might have been adduced in the text to throw light on general principles. If we may venture to criticise the plan of the work in one particular we think that marine climates receive less attention than they deserve, while mountain climates have got perhaps more than their share of space; Continental and Marine occupy together 94 pages, while Mountain Climates fill 153 pages. The disparity of course does not extend to the untranslated volumes on Special Climatology. It is much to be wished that this

sound and sensible treatise would be widely read by the general public, who would thereby learn to respect the scientific treatment of difficult problems and to distrust the assertions of empirics. For this reason alone we regret the retention of the centigrade degree and the metric system; but for these our journalists would we doubt not have made much use of the volume, greatly to the improvement of newspaper notes on climatic cycles and the like.

METEOROLOGICAL NEWS AND NOTES.

THE EARTHQUAKE of March 25th, 1903, which was severely felt in the North Midland Counties, was hardly noticeable in Northamptonshire. Mr. C. A. Markham informs us that the most southerly point at which the earthquake occurred was at Kettering. At that town Mr. C. W. Stringer states that he was sitting in his office writing a letter at about 1.27 and distinctly felt his table heave twice, the wave being southerly to northerly, and heard very slight shaking of the windows, &c., and a slight rumbling sound. He recognised it at once as an earthquake and called out to his junior clerk and the office-boy, who were then the only others in the building, enquiring if they had felt it, but they had not; nor had it been felt by any of his family or servants in his house close to the office, nor by several other persons of whom he enquired. At Easton-on-the-Hill the shock was felt by Mr. N. Day, and at Burghley House by Stamford Town, the earthquake was distinctly felt by the Marquis of Exeter, whilst he was lunching, and also by his servants.

THE CLOUD WORLD is the title of a new work on the forms and phenomena of clouds, by the Rev. Samuel Barber, which will shortly be published by Mr. Elliot Stock.

THE SOCIÉTÉ MÉTÉOROLOGIQUE DE FRANCE celebrated the fiftieth anniversary of its foundation on June 3rd, 1903, when telegrams of congratulation were received from the Royal Meteorological Society and from other foreign well-wishers of the Paris society.

THE TREASURY COMMITTEE on the administration of the Parliamentary grant to the Meteorological Council has, we understand, completed the hearing of evidence and is now preparing its Report.

AN INTERNATIONAL KITE COMPETITION will be held on the Sussex Downs on June 25th, under the auspices of the Aëronautical Society of Great Britain, when the Society's silver medal is to be awarded for the highest flight of a single kite (above 3,000 feet) carrying a weight equivalent to that of a meteorograph.

THE VISITATION OF GREENWICH OBSERVATORY took place on Saturday, June 6th, when exceptionally fine weather favoured the inspection of the instruments, and made this annual meeting of scientific men more than usually agreeable.

RAINFALL AND TEMPERATURE, MAY, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·99	+ 1·43	·78	9	17	80·9	30	34·9	13	0	1
II.		Tenterden	2·34	+ ·53	·58	6	13	79·3	30	32·5	13	0	3
,,		Hartley Wintney	3·09	+ 1·23	·53	3	18	79·0	31	32·0	13	1	1
III.		Hitchin	3·42	+ 1·68	1·41	9	14	...	...	...	...	...	...
,,		Winslow (Addington)	3·70	+ 1·99	1·01	9	15	77·0	22	32·0	13	1	4
IV.		Bury St. Edmunds (Westley)	2·54	+ ·70	·71	9	13	79·0	30	35·0	13*f*	0	...
,,		Norwich (Brundall)	1·58	— ·23	·62	8	11	75·2	22	32·0	13	1	4
V.		Winterborne Steepleton	3·36	...	1·06	28	14	75·5	31	31·2	13	2	5
,,		Torquay	3·15	...	·69	2	16	71·3	31	40·3	13	0	0
,,		Polapit Tamar [Launceston]..	2·68	+ ·44	·52	2	19	71·9	25*a*	51·2	30	1	4
VI.		Stroud (Upfield)	4·18	+ 2·29	·56	8	20	75·0	22	39·0	12	0	...
,,		Church Stretton (Woolstaston)	4·70	+ 2·40	1·18	5	18	71·5	22*a*	32·5	12	0	...
,,		Worcester (Diglis Lock)	6·10	+ 4·36	1·85	28	19	...	...	...	...	...	...
VII.		Boston	3·26	+ 1·76	·85	8	14	84·0	31	35·0	12	0	...
,,		Hesley Hall [Tickhill].....	2·51	+ ·97	·47	3	15	79·0	22	29·0	12*g*	3	...
,,		Derby (Midland Railway).....	3·15	+ 1·30	·68	1	20	84·0	31	34·0	13	0	...
VIII.		Bolton (The Park).....	3·78	+ 1·04	·94	2	20	76·4	31	33·9	12	0	2
IX.		Wetherby (Ribston Hall) ...	4·38	+ 2·71	·98	9	17	...	...	...	...	...	...
,,		Arncliffe Vicarage.....	3·48	+ ·09	.49	13	22	...	...	...	...	...	...
,,		Hull (Pearson Park).	2·96	+ 1·15	·90	8	15	71·0	22	30·0	11*h*	2	6
X.		Newcastle (Town Moor)	2·39	+ ·64	·34	1	15	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	7·94	+ ·60	1·14	16	20	75·8	31	32·3	12	1	...
XI.	WALES.	Cardiff (Ely).....	3·02	+ ·67	·92	16	14	...	...	...	...	...	...
,,		Haverfordwest	3·37	+ 1·08	1·15	8	14	71·8	26	34·1	12*i*	0	4
,,		Aberystwith (Gogerddan) ...	2·29	— ·23	·56	16	11	78·0	24	22·0	11	3	...
,,		Llandudno.....	1·70	— ·13	·40	3	16	73·0	22*b*	33·5	12	0	...
XII.		Cargen [Dumfries]	3·81	+ 1·17	·74	4	17	74·0	25*j*	33·0	11	0	...
XIII.		Edinburgh (Royal Observatory)	1·17	...	·35	4	13	68·2	31	35·5	11	0	4
XIV.		Colmonell	3·20	+ ·74	·50	16*k*	16	78·0	27*c*	33·0	18	0	...
XV.		Tighnabruaich	3·46	...	·52	13	15	69·0	26*d*	34·0	10	0	...
,,		Mull (Quinish).....	3·32	+ ·17	·73	16	16	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·63	— ·66	·40	5	11	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·25	— ·51	·40	3	10	71·5	25	32·0	11	1	...
VII.		Braemar	1·26	— ·93	·31	4	13	72·4	26	28·1	19	4	13
,,		Aberdeen (Cranford)	2·75	+ ·74	·87	4	13	70·0	31	32·0	8	1	...
,,		Cawdor (Budgate)	2·25	+ ·15	·64	4	14	...	...	...	...	...	...
VIII		Strathconan [Beauly]	2·20	+ 1·12	...	...	...	...	...	...	...	...	...
,,		Glencarron Lodge.....	4·31	— ·94	1·07	13	17	73·5	27	33·0	19	0	...
XIX.		Dunrobin	...	...	...	...	...	...	...	...	...	...	...
,,		S. Ronaldshay (Roeberry) ...	...	...	...	...	...	...	...	...	...	...	...
XX.		Darrynane Abbey.....	2·97	+ ·53	·70	2	18	...	...	41·0	10	0	...
,,		Waterford (Brook Lodge) ...	2·29	— ·36	·89	2	16	71·5	27	35·0	18	0	...
,,		Broadford (Hurdlestown) ...	3·77	+ 1·54	·83	29	19	72·0	26*d*	36·0	1	0	...
XXI.		Carlow (Browne's Hill)	3·01	+ ·71	·79	7	16	...	...	...	...	...	...
,,		Dublin (Fitz William Square)	2·38	+ ·48	·48	29	17	68·0	25*c*	40·9	17	0	6
XII.		Ballinasloe	1·91	— ·54	·35	2	17	74·0	28	35·0	24	0	...
,,		Clifden (Kylemore)	4·35	— ·27	·50	21	18	...	...	...	...	...	...
XIII		Seaforde.....	3·14	+ ·83	·75	16	19	82·0	25*e*	32·0	10*f*	2	3
,,		Londonderry (Creggan Res.).	2·40	— ·24	·46	4	18	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·56	+ ·02	·35	4, 16	19	77·0	26	35·0	10	0	...

+ *Shows* that the fall was above the average ; — that it was below it.

nd 31. b and 24. c and 28. d and 27. e and 26, 27. *f* and 18. *g* and 13. *h* and 12. *i* and 19. *j* and 27 and 30. *k* and 29.

SUPPLEMENTARY RAINFALL, MAY, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	3·95	XI.	Llandefaelog-fach.....	2·78
II.	Dorking, Abinger Hall .	3·48	,,	New Radnor, Ednol.....	4·09
,,	Sheppey, Leysdown	3·32	,,	Rhayader, Nantgwillt...	4·96
,,	Hailsham	2·33	,,	Lake Vyrnwy	3·03
,,	Crowborough.....	2·40	,,	Ruthin, Plâs Dràw	3·15
,,	Ryde, Beldornie Tower..	2·40	,,	Criccieth, Talarvor	2·29
,,	Bournemouth, Kempsey	2·73	,,	I. of Anglesey, Lligwy..	1·85
,,	Emsworth, Redlands ...	3·05	,,	Douglas, Woodville.....	2·96
,,	Alton, Ashdell	3·49	XII.	Stoneykirk, Ardwell Ho.	3·94
,,	Newbury, Welford Park	3·77	,,	Dalry, Old Garroch	3·38
III.	Oxford, Magdalen Coll..	4·16	,,	Monlaive, Maxwelton Ho.	2·63
,,	Banbury, Bloxham	5·05	,,	Lilliesleaf, Riddell	2·02
,,	Pitsford, Sedgebrook ...	2·89	XIII.	N. Esk Res. [Penicuick]	2·35
,,	Huntingdon, Brampton.	2·52	XIV.	Dalry, Blair	3·48
,,	Wisbech, Bank House...	2·46	,,	Glasgow, Queen's Park..	...
IV.	Southend	2·22	XV.	Inveraray, Newtown ...	2·98
,,	Colchester, Lexden	3·35	,,	Ballachulish, Ardsheal...	3·25
,,	Saffron Waldon, Newport	2·31	,,	Campbeltown, Redknowe	3·69
,,	Rendlesham Hall	1·82	,,	Islay, Eallabus.....	1·94
,,	Swaffham	2·14	XVI.	Dollar.....	1·73
V.	Salisbury, Alderbury ...	3·13	,,	Balquhidder, Stronvar...	...
,,	Bishop's Cannings	4·18	,,	Coupar Angus Station...	1·23
,,	Ashburton, Druid House	2·71	,,	Blair Atholl	1·66
,,	Okehampton, Oaklands.	2·53	,,	Montrose, Sunnyside ...	1·61
,,	Hartland Abbey	1·95	XVII.	Alford, Lynturk Manse..	2·26
,,	Lynmouth, Rock House	2·74	,,	Keith H.R.S.....	2·59
,,	Probus, Lamellyn	2·49	XVIII.	Fearn, Lower Pitkerrie..	1·24
,,	Wellington, The Avenue	3·60	,,	S. Uist, Askernish	1·48
,,	North Cadbury Rectory	2·60	,,	Invergarry.....	2·86
VI.	Clifton, Pembroke Road	3·38	,,	Aviemore, Alvie Manse.	2·02
,,	Ross, The Graig	4·22	,,	Loch Ness, Drumnadrochit	2·11
,,	Shifnal, Hatton Grange	2·68	XIX.	Invershin	1·80
,,	Wem, Clive Vicarage ...	...	,,	Bettyhill	1·48
,,	Cheadle, The Heath Ho.	2·74	,,	Watten H.R.S.....	1·63
,,	Coventry, Kingswood ...	3·36	XX.	Cork, Wellesley Terrace	3·04
VII.	Market Overton	3·54	,,	Killarney, District Asyl.	3·07
,,	Grantham, Stainby	4·06	,,	Glenam [Clonmel]	4·09
,,	Horncastle, Bucknall ...	1·65	,,	Ballingarry, Hazelfort...	1·71
,,	Worksop, Hodsck Priory	2·49	,,	Miltown Malbay	2·80
VIII.	Neston, Hinderton	3·10	XXI.	Gorey, Courtown House	2·42
,,	Southport, Hesketh Park	2·39	,,	Moynalty, Westland ...	2·58
,,	Chatburn, Middlewood.	3·81	,,	Athlone, Twyford	1·77
,,	Duddon Val., Seathwaite Vic.	3·74	,,	Mullingar, Belvedere ...	1·43
IX.	Langsett Moor, Up. Midhope	4·27	XXII.	Woodlawn	2·63
,,	Baldersby	4·27	,,	Westport, Murrisk Abbey	2·40
,,	Scalby, Silverdale	3·22	,,	Crossmolina, Enniscoe ..	2·49
,,	Ingleby Greenhow Vic..	2·72	,,	Collooney, Markree Obs.	2·31
,,	Middleton, Mickleton ...	2·52	XXIII.	Enniskillen, Portora ...	2·46
X.	Beltingham	2·62	,,	Warrenpoint.....	2·29
,,	Bamburgh	·80	,,	Banbridge, Milltown ...	2·31
,,	Keswick, The Bank.....	2·56	,,	Belfast, Springfield	2·74
,,	Melmerby Rectory	2·89	,,	Bushmills, Dundarave..	2·60
XI.	Llanfrechfa Grange	4·27	,,	Stewartstown	3·06
,,	Treherbert, Tyn-y-waun	5·92	,,	Killybegs	3·09
,,	Castle *Malgwyn*	2·64	,,	Horn Head	2·69

METEOROLOGICAL NOTES ON MAY, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder: L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—The earlier part was unsettled with a good deal of R, ·78 in. falling in TS8 on 8th. Finer weather prevailed from 12th to 15th. TS8 and H on 17th and fine till 27th; broken only by a slight TS on 22nd. Heavy TS at mid-day on 28th, and TS8 on 30th and 31st. Mean temp. 55°·0 or 1°·0 above the average.

TENTERDEN.—First part rather wet and cold; fine and warm after 20th; and the last three days very hot with T, but no severe storm. Duration of sunshine 219 hours. TS8 on 10th and 31st.

SHEPPEY, LEYSDOWN.—Fine until 6th. On 9th ·54 in., principally H, was recorded in about half-an-hour. Very fine from 18th to 28th. T on four days.

CROWBOROUGH.—The early days were extremely wet, a continuation of the rainy period which began on April 25th. From 8th to 13th was unusually cold, with a little sleet on 12th and ground frost on 13th. It then became warmer and the month closed exceedingly hot. Severe TS from 10 p.m. on 30th to 2 a.m. on 31st.

HARTLEY WINTNEY.—The first part was exceedingly wet and the whole month bitterly cold. No ozone was registered. TS8 on 4 days and L on 3.

COLCHESTER, LEXDEN.—R was measured on 17 consecutive days ending on May 11th; this period was mild with little sunshine. The latter half was warm and bright with light winds from N. or E. On 10th and 11th 1·98 in. of R fell in 26 hours, causing the highest floods since 1894. TS on 9th.

WINTERBORNE STEEPLETON.—R 1·77 in. above the average of 10 years. Mean temp. 51°·5 or 1°·2 higher than the average of 10 years. TS on 28th.

TORQUAY, CARY GREEN.—R 1·19 in. above the average. Duration of sunshine 221·3 hours, being 9·4 hours below the average. Mean temp. 53°·8 or 0°·7 above the average. Mean amount of ozone 5·2. Max. 7·5 on 3rd with S.E. wind; min. 2·0 on 5th with W.N.W., and on 28th with N.E. wind.

LYNMOUTH, ROCK HOUSE.—Cold in the early part, especially on 16th, 17th and 18th. The latter part was warm with very light E. airs.

NORTH CADBURY RECTORY.—Changeable with no extremes. R considerable and temp. decidedly high. Grass frosts were very few and slight. T on 3 days and L on one.

CLIFTON, PEMBROKE ROAD.—Rainy and unsettled till 17th with a cold spell from 9th to 12th. Fine and warm from 21st to 26th with cloudless skies, then thundery and sultry to the end. TS8 on 4 days and T only on 2. R 1·15 in. above the average.

ROSS, THE GRAIG.—Mean temp. 53°·5 or 0°·8 above the average of 33 years. R nearly double the average, the fall for 37 days ending on 31st being the highest yet measured in that period of the year except in 1886. No frost in the screen, and only 0°·2 on one night on grass.

BOLTON, THE PARK.—Strong contrasts of cloudiness and sunshine, cold and warm periods. R fell each day till 11th, being persistent from the morning of 2nd to the evening of 5th; the amount of R during the 11 days was 3·03 in., and the duration of sunshine only 4 hrs. 25 mins. Remarkably warm and bright from 21st to the end. Mean temp. 49°·8 or 0°·1 above the average. Bright sunshine occurred on 23 days, totalling 121 hrs. 40 mins., or 34 hrs. 5 mins. below the average.

WALES AND THE ISLANDS.

ABERYSTWITH, GOGERDDAN.—Very cold on several occasions; 10° of frost on 11th, working havoc with fruit, flower and vegetable.

DOUGLAS, WOODVILLE.—Cold, wet and wintry to 20th, when it suddenly changed to brilliant sun all day, albeit accompanied by cold E. winds and nightly frosts. The sunshine had a marvellous effect in bringing out the belated foliage of earlier forest trees, but otherwise was no "unmixed blessing" *horticulturally*. Ash and poplar still showed little sign even of bud at the end.

SCOTLAND.

LILLIESLEAF, RIDDELL.—The wind continued in the E. for over two-thirds of the month. The prevalence of easterly winds for the last six months is very remarkable. Sudden change in temp. on 22nd, and on 31st shade max. was 77°.

MULL, QUINISH.—Cold, wet and backward until 22nd, when wind shifted to the S. with heavy R. The summer heat of the rest of the month worked wonders and brought on crops and foliage marvellously.

COUPAR ANGUS.—Although not severe, it was cold and harsh up to the 24th, when a sudden change set in, and a noteworthy feature of the month was the abnormally high day temp. of the last week. Mean temp. for the month 42°·0.

BETTYHILL.—There was but little R, and the weather was favourable for out-door work. Except during the last week the wind was cold and dry.

WATTEN, H. R. S.—The opening week was cold, cloudy and wet; the middle cloudy, with cold N. winds; the last week mild and fine.

IRELAND.

CORK, WELLESLEY TERRACE.—R ·86 in. above the average, and for the past five months 6·65 in. above the average. On the afternoon of 30th ·50 in. of R fell in 45 mins. Mean temp. 1°·9 below the average. T and L on 6th.

DARRYNANE ABBEY.—The first three weeks were wet and ungenial, and the last 10 days fine and warm with a TS on the afternoon of the 29th.

MILTOWN MALBAY.—May opened genial and seasonable with fine vegetation till 9th, when chilling cold winds from N. set in with occasional R and blustery weather up to 23rd, when heat returned. T 5th and 7th, T and L on 29th.

DUBLIN, FITZWILLIAM SQUARE.—Two seasons were presented by May, 1903, cold, dull and rainy during the first 16 days, whereas the second half was fair, bright, dry and summerlike, except on 29th and 30th, when heavy R fell. Mean temp. 52°·9 or 0°·8 above the average. H on 12th and L on 19th.

OMAGH, EDENFEL.—The weather of the first half was apparently but little improvement on that of April. The day temp. was below the normal, and most of the R fell by day, but the night temp. and the mean of the first fortnight were above the average. The second half was, however, in all respects, the most favourable for many years. With a max. temp. of 77° on 26th and 5 consecutive days above 70°, all the season's lee-way was made up.

THE FIVE MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—May, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	+2·69	135	Arncliffe ...+	...	...	Braemar ...+	9·86	182
Tenterden	+1·37	115	Hull	+1·89	122	Aberdeen	+3·08	128
Hartley Wintney	+4·18	148	Newcastle.....	+ ·23	103	Cawdor	+4·71	147
Hitchin	+3·87	149	Seathwaite +	23·05	145	Glencarron +	15·89	146
Winslow.....	+3·58	145	Cardiff	+5·71	142	Dunrobin	...	...
Westley.....	+ ·57	107	Haverfordwest	+6·51	142	Darrynane ...	+2·48	114
Brundall.....	— ·27	97	Gogerddan ...	+4·87	132	Waterford ...	+4·21	130
Alderbury	+4·87	150	Llandudno ...	+5·13	151	Broadford.....	+6·39	154
Ashburton	+5·86	131	Dumfries ...+	11·17	169	Carlow	+6·32	151
Polapit Tamar ...	+5·89	147	Lilliesleaf	+7·36	170	Dublin	+2·77	128
Stroud	+5·60	159	Colmonell	+4·33	127	Mullingar.....	+7·48	158
Woolstaston	+5·50	153	Glasgow ...+	...	...	Ballinasloe ...	+5·94	146
Boston	+2·84	142	Inveraray ...+	11·93	144	Clifden	+5·40	119
Hesley Hall	+1·87	126	Islay	+6·47	140	Crossmolina ...	+8·04	141
Derby.....	+3·76	148	Mull	+7·32	135	Seaforde	+4·74	136
Bolton	+4·03	131	Loch Leven +	10·70	183	Londonderry..	+3·73	126
Wetherby	+5·58	169	Dundee	+1·86	119	Omagh	+8·59	163

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DECEMBER, 1902.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0.100	°	°	inches		
London, Camden Square	56·8	17	22·5	7	44·9	37·6	38·5	91	66·2	18·9	1·51	12	7·5
Malta	67·0	1	41·0	26	60·3	50·7	47·6	76	109·6	38·5	3·23	13	5·0
Lagos, W. Africa	91·1	14	66·1	29	88·2	76·9	75·8	80	142·0	...	·00	0	...
Cape Town	94·0	23	45·7	26	78·1	59·2	56·1	65	...	...	·29	2	3·1
Durban, Natal	91·4	9	58·2	20	83·3	66·2	...	...	147·3	...	3·96	18	6·6
Mauritius	88·5	1	68·0	31	84·4	73·4	71·1	79	153·5	63·3	9·85	27	7·5
Calcutta	84·0	18	48·4	30	77·2	56·1	51·9	61	137·0	43·9	·66	1	2·0
Bombay	88·2	2	67·1	21	83·9	72·0	67·2	71	137·7	56·9	·81	5	3·3
Madras	86·3	11	63·9	29	82·9	71·9	70·1	83	140·1	59·0	9·18	11	5·8
Kodaikanal	67·1	30	42·2	29	60·8	49·4	48·7	82	129·2	30·1	9·84	13	5·5
Colombo, Ceylon	89·4	18	71·6	30	86·9	73·9	72·0	80	151·5	69·0	6·43	11	5·6
Hongkong	76·9	2	51·1	14	68·6	61·0	56·5	75	130·1	...	2·97	13	8·2
Melbourne	101·7	5	48·0	30	75·5	55·6	52·0	68	160·1	39·8	4·35	11	6·4
Adelaide	99·0	4	48·9	1	80·4	58·7	50·9	51	161·1	40·1	2·57	10	5·3
Coolgardie	108·6	20	47·8	10	89·5	59·1	...	...	166·2	...	·17	3	3·8
Sydney	100·0	24	60·5	1	78·3	65·0	60·9	68	140·1	53·0	2·80	16	5·7
Wellington	71·0	12	41·0	4	63·6	50·1	45·5	65	136·0	33·0	3·74	19	6·2
Auckland	75·5	14	50·0	7	67·4	54·5	47·7	62	138·0	46·0	2·83	17	4·7
Jamaica, Negril Point	87·7	11	66·2	21*a*	84·9	70·8	70·4	78	...	...	4·73	8	...
Trinidad	97·0	1	66·0	7	87·5	69·5	75·3	92	164·0	60·0	2·89	7	...
Grenada	85·0	16	72·0	8	82·7	73·5	71·7	76	148·8	...	5·27	22	2·9
Toronto	45·8	3	—3·3	9	31·1	17·6	22·0	81	62·4	—10·2	2·22	17	7·5
Fredericton, N.B.	51·8	23	—16·8	13	26·7	7·8	6·0	60	...	...	4·35	14	5·6
Winnipeg	35·2	31	—30·7	25	14·1	—5·0	...	...	...	...	1·50	9	4·8
Victoria, B.C.	53·1	25	32·2	2	44·9	37·1	37·8	89	...	...	6·23	18	8·3
Dawson	29·0	14	—51·0	22	-16·7	—28·2	...	...	...	...	·80	4	5·3

a—and 23.

MALTA.—Mean temp. of air 55°·2, or 1°·1, below; mean hourly velocity of wind 12·2, or 1·1 above averages. Mean temp. of sea 63°·9. T8S on 3 days. J. F. DOBSON.

LAGOS.—The Harmattan prevailed during the latter half of month. A. CLEMINSON.

Mauritius.—Mean temp. of air 0°·1, dew point 2°·8, and R 4·92 in., above averages, and mean hourly velocity of wind 0·4 miles below average. T. F. CLAXTON.

MADRAS.—Rainfall about 75 per cent. above average. R. D. JONES.

KODAIKANAL.—Bright sunshine 124·9 hours. Mean temp. of air 54°·1. Mean velocity of wind 317 miles per day. C. P. BUTLER.

COLOMBO.—Mean temp. of air 79°·5, or 0°·4 above, of dew point 1°·0 above, and R ·17 in. above, averages. Mean hourly velocity of wind 7·8 miles. H. O. BARNARD.

HONGKONG.—Mean temp. of air 64°·6 or 2°·2 above, R 1·96 in. above, averages. Sunshine 71·9 hours, or 117·8 below, average. Mean hourly velocity of wind 11·2 miles; prevailing direction E.N.E. F. G. FIGG.

Adelaide.—Mean temp. 1°·9 below, and R 1·75 in. above, averages. C. TODD, F.R.S.

Sydney.—Mean temp. 1°·8 above, humidity 0°·8 below, and R ·29 in. above, averages. H. C. RUSSELL, F.R.S

Wellington.—Mean temp. 1°·8 below, and R ·75 in. below, averages. A. H. GORE.

Auckland.—Mean temp. nearly two degrees below average, R half an inch above average. T. F. CHEESEMAN.

TRINIDAD.—R 1·91 in. below the 40 years' average. J. H. HART.

SYMONS'S

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THE RAINFALL OF JUNE, 1903.

THE month of June, 1902, exhibited a peculiarity of rainfall, the wettest part of the British Isles having been the south of England and the driest part the north of Ireland and Scotland (see this Magazine for July, 1902, p. 88). The month of June, 1903, exhibits the same peculiarity in a more intense and, we believe, an unprecedented degree, and we therefore deal with the distribution in more detail on this occasion, and illustrate it by a map on a larger scale than that given last year.

To a certain extent the rainfall tends towards a more uniform distribution in June than in other months, for in the wet western and north-western districts it is usually the driest month of the year, while in the dry southern and south-eastern parts of the country the greater frequency of thunderstorms often makes it a wet month. The wetness of a wet June is usually due to torrential rain affecting small and scattered areas and falling only for a few hours; it is usually accompanied by great heat. Both in 1902 and 1903 the wetness of June in the south of England has been due to long-continued steady rain lasting for many hours at a time, not accompanied by thunder except on rare occasions, but associated with exceptionally low temperature. The rain was, in fact, rather of an autumnal than a midsummer type.

We have prepared the accompanying map from data supplied by more than 400 observers, to many of whom special requests were addressed so that the area of the heaviest fall could be determined as accurately as possible. We are particularly grateful to Mr. F. Campbell Bayard and Mr. W. Marriott for the number of records they supplied. Some parts of Scotland, Ireland and Mid-Wales, were sketched in from infrequent data; but the whole of the south of England was well represented, and so far as its scale admits the map may be accepted as substantially correct.

Where less than two inches of rain fell in the month the map is left unshaded, while lines are drawn for every inch of rainfall, the shading above two inches being made darker in proportion to the fall. It will be seen that the north and north-west of Ireland and some of the islands of the Outer Hebrides had less than one inch of rain, about one-third or one-quarter of the average amount, and a narrow belt from Stafford to Lincoln was equally dry. The north and east

THE BRITISH ISLES

THE RAINFALL OF JUNE, 1903.

of Scotland and the centre of the north of England, together with the greater part of Ireland, had less than two inches.

The Lake District contained a very small area over three inches, a larger area with a fall of equal amount occurred near the coast in the north-east of England, while a comparatively large region in the west of Scotland had a rainfall very slightly exceeding three inches, but in no place greater than the average fall for the month, and in very few approaching it. A fairly large area in the middle of Wales also slightly exceeded three inches, and probably falls of four inches or over occurred in some part of the Principality. In the south of Ireland the amount of rainfall increased towards the south coast, the whole of which had more than four inches, and in the south-east more than five inches of rain.

The most interesting distribution, however, is that over England. A broad dry belt in which the fall scarcely anywhere reached two inches (and nowhere reached the average for the month), stretched from North Wales and the Mersey to the Humber and the Wash, separating a slightly higher rainfall on the north from an excessively high rainfall on the south. The wet zone stretched from west to east across the country. Along the axis of it, from Swindon to Southend, for a distance of 110 miles, the rainfall exceeded 6 inches (or more than three times the average amount), the greatest breadth of the belt with a rainfall nowhere less than 6 inches was 40 miles between Hertford and Red Hill. This extremely heavy fall prevailed over the greater part of the valley of the Thames and Lea, and in the south, especially in the neighbourhood of Croydon, it exceeded 7 inches and in one case reached the unprecedented figure of 8·91 inches. The total area on which the fall exceeded 6 inches may be estimated at 2240 square miles, of which about 90 square miles had over 7 inches. Surrounding this very wet area was a belt from 5 to 20 miles wide, with over 5 inches of rain, covering 3300 square miles, and outside that a belt from 4 to 15 miles wide, in which the rainfall exceeded 4 inches, an area of 3700 square miles.

Assigning to each of these areas the average rainfall indicated by a large scale map, on which all the figures were plotted, we get the following table :—

	Area (sq. miles).	Rainfall (in.)	Volume of water (square mil.x in).
More than 7 in.	90	7·3	657
Between 6 in. and 7 in.	2150	6·3	13545
Between 5 in. and 6 in.	3300	5·6	18480
Between 4 in. and 5 in.	3700	4·5	16650
Above 4 in.	9240		49332

This gives an average rainfall over the 9240 square miles of 5·3 inches. One inch of rain over one square mile of area is equal to about 64,660 tons of water, or 14,483,000 gallons. As the area of heaviest fall was central over the middle and lower Thames, and as the whole of the Upper Thames basin lay within the area on

which more than 4 inches of rain fell, it is, of course, understating the average rainfall of the Thames valley if we put it at 5·3 inches. It will be an understatement, we believe, to put it at 5·5 inches for the month of June, 1903; but it may be conveniently taken at that figure for the purpose of calculation. The total drainage areas of the Thames and Lea above Teddington and Feilde's Weir, respectively, is approximately 4200 square miles, so that for the month of June, or rather for the ten days between June 8th and 19th, during which all the rain fell, the amount of water deposited on the drainage area of the two rivers was 1494 million tons, or 334,560 million gallons.

Taking the mean rainfall over the county of London at 6·3 inches, which is a reasonable estimate, though probably too low, the amount of water which fell on the 117 square miles of the metropolitan county amounted to nearly 48 million tons, or 10,675 million gallons. At Camden Square the rain fell during 110 hours, and on the assumption that this rate held good for the whole county, the amount of water deposited in London during the period when it was falling, averaged 433,000 tons, or 97,000,000 gallons per hour.

The usual tables published in this number give the rainfall for June at about 150 stations, and we have not space to print all the additional records. The extremes, however, are so interesting that we give below a statement of the 30 highest and the 14 lowest falls that have been reported to us. It is enough to say that the former are all in a region where the June fall is normally about two inches, the latter are mainly in districts where the June fall usually considerably exceeds three inches.

Thirty Wettest Stations in June, 1903.

		in.
Carshalton Sewage Works	*Surrey*	8·91
Brimstone Barn, Croydon	,,	8·10
Park Farm, Addington	,,	8·04
Waddon New Road, Croydon	,,	7·76
Ashburton Road, ,,	,,	7·62
Park Hill Rise, ,,	,,	7·51
Hayes	*Kent*	7·39
Pyrford Croft	*Surrey*	7·38
Duppas House, Croydon	,,	7·20
Wallington, ,,	,,	7·09
Beddington, ,,	,,	7·03
Burgh Heath, Banstead	,,	7·00
The Hemnalls, Epping	*Essex*	6·96
Avondale Road, Croydon	*Surrey*	6·95
Addington	,,	6·92
Sanderstead	,,	6·92
Bickley	*Kent*	6·92
D'Abernon Chase, Ashtead	*Surrey*	6·91
South Norwood	,,	6·91
Lindisaye, Horsell	,,	6·90
Worcester Park	,,	6·84
Beckenham	*Kent*	6·84
Letcombe Regis	*Berkshire*	6·84

		in.
Broxbourne	*Hertfordshire*	6·84
Bromley	*Kent*	6·81
Belle Vue, Staines	*Middlesex*	6·81
Banstead	*Surrey*	6·77
Benhilton	,,	6·76
Warlingham	,,	6·76
Horsley Towers	,,	6·76

Fourteen Driest Stations in June, 1903.

		in.
Markree Observatory, Collooney	*Sligo*	·70
Dunderave, Bushmills	*Antrim*	·72
St. Helen's, Westport	*Mayo*	·79
Murrisk Abbey, ,,	,,	·83
The Heath House, Cheadle	*Staffordshire*	·85
Creggan Reservoir	*Londonderry*	·87
Bucknall, Horncastle	*Lincolnshire*	·88
Horn Head	*Donegal*	·89
Letterkenny	,,	·90
Watten	*Caithness*	·91
Lincoln	*Lincolnshire*	·91
Duffield	*Derbyshire*	·93
Enniscoe	*Mayo*	·94
Eallabus, Islay	*Argyll*	·94

So far we have spoken of the total rainfall, we now have to examine the way in which it was distributed throughout the month. For this purpose the dates of days with rain for 150 well-distributed stations were written out and compared. The smallest number of rainy days occurred in Norfolk, where two stations showed respectively five and six days; the largest number occurred in parts of the east coast of Great Britain, 18 rainy days having been experienced at Cawdor in Nairnshire and 16 or 17 days in parts of the East Riding of Yorkshire, Forfarshire, Aberdeenshire, and also in Co. Donegal. The number of days bore no relation to the amount of fall. Over the whole country the average number of rainy days was 10·2, and in the area of heaviest fall the number of rainy days was almost without exception either 9 or 10. In that area also the total fall for the month occurred between the 8th and the 19th in two wet spells, one from the 8th to the 11th, the other from the 13th to the 19th; but in the second spell either the 17th or the 18th was usually dry. The first rainy spell did not extend to the extreme east of England, thus accounting for the small number of rainy days in that locality. In the west of England the first rainy spell consisted of only two days, the 8th and 9th, and brought little rain. The latter part of the second rainy spell, about the 19th, was very wet, and a third rainy spell occurred between the 23rd and 25th. In the north of England, Scotland and Ireland, the rains of the month were more frequent but much less intense. The days were not so clearly grouped into spells as in the south and west, indeed only the third spell, which occurred in the last week of the month, was a well defined wet period.

London lay in the very centre of intensity of the mid-June deluge, and although the neighbourhood of Croydon had fully an inch more rain than the north of London, the Camden Square record represents very nearly the average amount for the lower Thames valley, and may thus be taken as typical of the whole of the very wet area. Rain to the depth of 6·43 in. fell on ten days, giving a fall of ·64 in. per rainy day, whereas the average fall (for 45 years) per rainy day in June is only ·19 in. On three of the ten rainfall days the fall exceeded one inch, and on two other days it exceeded half-an-inch. The record of the self-recording gauge shows that there were only eleven showers during the ten rainy days, the word *shower* being used to denote a period of continuous rain. Of these, three showers had a duration of only half-an-hour each, and one lasted for an hour and a quarter; the other seven each exceeded four hours. The following is an exact statement of the duration, amount and average intensity of the rain at Camden Square. The dates refer to the civil day.

Shower.	Rain commenced.	Rain ceased.	Duration of shower.	Amount of rain.	Intensity per hour.
i.	June 9th, 2.45 a.m.	7.30 a.m.	4 h. 45 m.	·51 in.	·107 in.
ii.	,, 10th, 2.15 a.m.	7.30 a.m.	5 h. 15 m.	·43 ,,	·082 ,,
iii.	,, 10th, 10.45 a.m.	6.15 p.m.	7 h. 30 m.	·09 ,,	·012 ,,
iv.	,, 10th, 11.15 p.m.	3.30 a.m. on 11th	4 h. 15 m.	·08 ,,	·019 ,,
v.	,, 11th, 1.15 p.m.	8.15 p.m.	7 h. 0 m.	·19 ,,	·027 ,,
vi.	,, 13th, 1.0 p.m.	11.30 p.m. on 15th	58 h. 30 m.	3·44 ,,	·059 ,,
vii.	,, 16th, 5.15 p.m.	5.45 p.m.	0 h. 30 m.	·21 ,,	·420 ,,
viii.	,, 16th, 7.45 p.m.	8.15 p.m.	0 h. 30 m.	·17 ,,	·340 ,,
ix.	,, 17th, 5.15 a.m.	5.45 a.m.	0 h. 30 m.	·02 ,,	·040 ,,
x.	,, 17th, 5.15 p.m.	6.30 p.m.	1 h. 15 m.	·15 ,,	·120 ,,
xi.	,, 19th, 9.15 a.m.	5.15 a.m. on 20th	20 h. 0 m.	1·14 ,,	·057 ,,
			110 h. 0 m.	6·43 in.	·058 in.

The only really heavy rain shown in the table is that which fell in the two short showers on the 16th, although portions of the longer showers showed individual half-hours of equal intensity. But attention is arrested by the extraordinary duration of steady uninterrupted rain from 1.0 p.m. on Saturday, the 13th, all that day, all Sunday, and all Monday until half-an-hour before midnight, when it stopped. These 58½ hours contributed more than half the month's fall; but it must be remembered that in the only wetter June at Camden Square of which records exist 3·28 in. fell in 56 minutes, from 1.32 p.m. to 2.12 p.m. and from 2.46 p.m. to 3.2 p.m., during a terrific thunderstorm on the 23rd of June, 1878. It was only in the shorter showers and once or twice for a short time during the longer falls that anything approaching the typical summer "thunder plump" was observed, and electrical disturbances were recorded from comparatively few places during the month.

The problem which this remarkable distribution of rain suggests to the meteorologist is a very puzzling one. It is to find the reason for a great wet area developing itself symmetrically along the valley of the lower Thames. The fact that the amount of rain bears little

relation to the configuration of the ground, and that where any relation is traceable it suggests a lower fall on the higher land, may be accepted as proof that it is the distribution of pressure in the air which must provide an explanation. The daily isobaric charts of the Weather Reports show that there was a distinct sympathy between rain and barometric pressure. From June 1st to 7th an anticyclone lay over the British Isles, the wind was steadily from north and north-east, and the weather generally dry. On the night of the 8th a low pressure area moved northward from France and continued over the south of England for four days, during which the first wet spell in the south took place. On the 12th the Atlantic anticyclone spread over the British Isles from the west bringing a dry day; on the 13th the pressure fell in the south, but again rose on the 18th, when a small low pressure area appeared over Scotland and inverted the gradient. On the 19th a well marked depression occupied the English Channel, and the rainfall over the extreme south of England was general and heavy while the north was dry. Next day the Atlantic anticyclone reasserted itself from the west and a period of absolute drought commenced in the south, which lasted at Camden Square unbroken for twenty-two days, a duration which has only been exceeded on eight occasions in the last forty-five years. Meanwhile the pressure in the north gave way about the 24th, and was relatively low until the end of the month, coinciding with the third wet spell, which did not extend to southern stations except in the west.

The difficulty is of course not removed, but merely shifted a step backward, by tracing the fluctuations of rainfall to variations in pressure, and there remains a reason to seek for the prolonged and steady rain which accompanied comparatively slight diminutions of pressure with very moderate gradients and little wind.

If space were available we should gladly print a selection of the numerous interesting letters we have received on the June rains, but we must ask the indulgence of our correspondents in this matter. For the same reason we must withhold a description of the floods in the Thames valley and in the rivers radiating from its southern watershed, for a long list of damage and loss would be necessary to do justice to the consequences of the ten days' deluge in the south, and —though in a less degree—to the troubles caused by drought in the north.

Correspondence.

RAINFALL IN THE LINCOLNSHIRE FENS, FROM RECORDS KEPT AT BOSTON.

To the Editor of Symons's Meteorological Magazine.

In a paper on the "Shortage of Water," reported in your Magazine for April last, Dr. H. R. Mill pointed out that the rainfall statistics did not bear out the theory of a secular diminution of rainfall in the British Isles, but that the deficiency in the central parts of England had been very great, reaching 16 or 17 per cent. for the ten years 1890-99.

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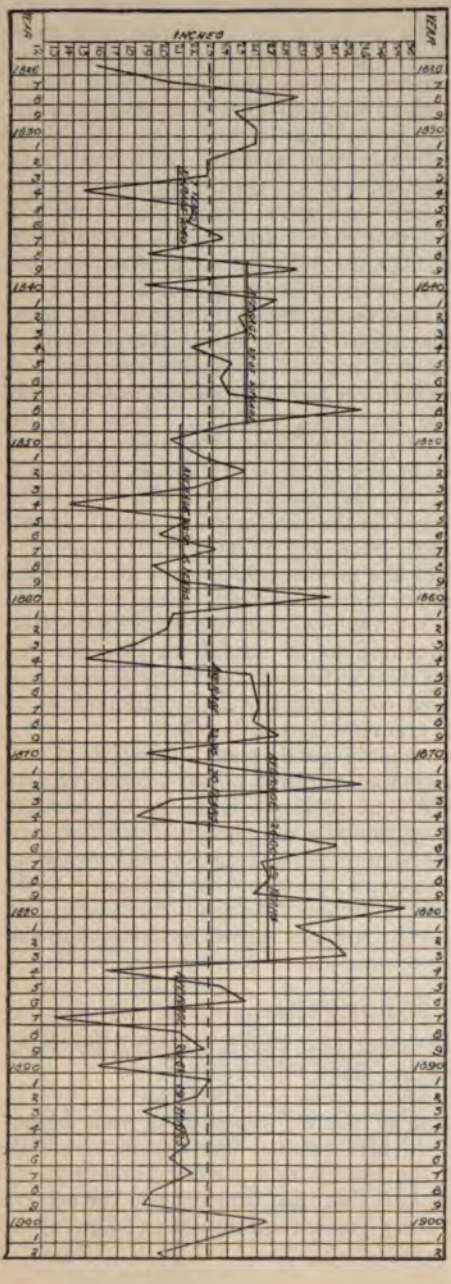


Bearing on this the accompanying statistics and diagram of rainfall recorded by me at Boston, the centre of the Lincolnshire Fen district, may be of interest.

With the year ending December, 1902, there were completed two cycles of 19 years, one being a wet and the other a dry period.

For the 19 years 1865-1883 the average annual rainfall amounted to 26·60 inches.

For the 19 years 1884-1902 the average was 20·62 inches.

The mean annual rainfall of the 70 years 1830-1899 was 22·93 inches.

The surplus above this average for the wet period 1865-1883 was 69·73 inches, and the deficiency for the dry period 1884-1902 was 43·94 inches.

During the first period there were 3 years when the average was not reached; and during the second period 3 years when it was exceeded.

The greatest annual rainfall during these two cycles was 35·53 inches and the least 12·94 inches.

The accompanying diagram shows the periods of wet and dry years during the last 70 years.

W. H. WHEELER,
M. Inst. C.E.

Boston, Lincolnshire,
April 24th, 1903.

CLOUD ESTIMATION.

To the Editor of Symons's Meteorological Magazine.

THE practice of estimating the amount of cloud on the scale of 0 to 10 may have its imperfections from the circumstance that at any given place of observation the portion of sky at lower altitudes has not the same relation to the place itself as the portion overhead. In our country, and in others also, the tendency of the sky is usually to a cloudy or nearly cloudy state, or to a clear or nearly clear state, represented in the former case by estimations of say from 8 to 10, and in the latter case by estimations of say from 0 to 3, in both of which extremes the estimations are probably not much affected by the cause mentioned, which perhaps applies more to the transition state, as represented by the estimations 4 to 7, in which the cloud may be so situated as to refer more to the surrounding neighbourhood than to the place of observation. This transition state is, however, the exceptional condition. Lately I was induced to examine how far or to what extent it is really exceptional. For this purpose I selected at random from the Greenwich Observations for 1843 eight periods of five consecutive days each, two in each for the months of March, June, September and December, and as the observations were made every two hours, their number was in all 480. The results are as follows :—

Group	I. (0-3)	II. (4-7)	III. (8-10)	Mean Amount of Cloud.
Number of Observations	144	49	287	
Percentage.....	30	10	60	6·6

Thus, as was expected, the percentage of observations falling in Group No. II. is small ; only 10 per cent. of the whole.

I further discussed the observations at two places very different in position—Hawes and Strathfield Turgiss—employing the daily records at these places at 9 a.m. and 9 p.m. throughout the years 1875 to 1877, as given in Volumes III. and IV. of the *Quarterly Journal of the Royal Meteorological Society.* The number of observations in each of the years 1875 and 1877 was 730, and in 1876 was 732 ; in all, 2192 : —

Group	I. (0-3)	II. (4-7)	III. (8-10)	Mean Amount of Cloud.
Hawes—				
Number of Observations ...	430	242	1520	
Percentage	20	11	69	7·6
Strathfield Turgiss—				
Number of Observations ...	673	260	1259	
Percentage	31	12	57	6·4

The mean cloud at Strathfield Turgiss, 6·4, being much less than at Hawes, 7·6, the percentage in Group I. at Strathfield Turgiss is correspondingly greater, and in Group III. correspondingly less. But the percentages in Group II. are again small and nearly similar : 12 at Strathfield Turgiss and 11 at Hawes ; at Greenwich it was 10.

It seemed interesting to examine this point further. I therefore separated the observations of the 36 months at each place into three

divisions according to magnitude of the monthly amount of cloud. The results for the two places are given together, adding also that for Greenwich, the number of observations being here omitted and percentage only given :—

	Group I. (0-3)	II. (4-7)	III. (8-10)	Mean Amount of Cloud.
Strathfield Turgiss	46	11	43	5·0
Hawes	31	14	55	6·3
Strathfield Turgiss	29	14	57	6·5
Greenwich.....	30	10	60	6·6
Hawes	19	10	71	7·7
Strathfield Turgiss	17	10	73	7·8
Hawes	9	9	82	8·7

Thus whilst the percentage of 46 in Group I., with mean cloud 5·0, becomes reduced to 9 with mean cloud 8·7, the percentage of 43 in Group III. is increased to 82. But the percentages in Group II. vary only from 9 to 14. If the sky at any place were always clear, the percentage in Group I. would become 100, with nothing in Groups II. and III. ; if always cloudy, the percentage in Group III. would become 100, with nothing in Groups I. and II. But in the range of ordinary observations it would appear that increased percentage in Group I. is accompanied by decreased percentage in Group III., with little change in Group II.

WILLIAM ELLIS.

June, 1903.

GRASS AND SHADE MINIMA ON A HILL AND IN A VALLEY.

To the Editor of Symons's Meteorological Magazine.

I HAVE for some years noticed that the difference between the grass and shade minima is much greater in a valley than on a hill-top. The following comparison well illustrates my point.

	At Beddington,* 120 ft. above sea, on Wandle Brook.				On Top of Wimbledon Hill,† about 270 ft. above sea.		
	Shade Min.	Grass Min.	Diff.		Shade Min.	Grass Min.	Diff.
	°	°	°		°	°	°
April 13.....	30	21	9	...	32	28	4
,, 14.....	28	20	8	...	31	27	4
,, 15.....	37	28	9	...	38	35	3
,, 16.....	25	16·9	8·1	...	28	23	5
,, 17.....	25	17	8	...	29	26	3
,, 18.....	26	17·6	8·4	...	29	26	3
,, 19.....	25	19	6	...	30	26	4
,, 20.....	26·8	20·2	6·6	...	31	27	4
,, 21.....	34·9	29·2	5·7	...	39	35	4
,, 22.....	35	32	3	...	36	33	3
,, 23.....	26·7	20	6·7	...	31	27	4
,, 24.....	34	29·8	4·2	...	35	32	3
,, 25.....	25	16·7	8·3	...	30	24	6

* A difference of 12°—15° has sometimes been noted here. Average difference about 7°. Soil, gravel on chalk.

† An average difference of about 4°. Soil, clay.

STANLEY SINGLE.

Park View, Wimbledon Park.

ROYAL METEOROLOGICAL SOCIETY.

THE concluding meeting of the present session was held on Wednesday afternoon, June 17th, at the Society's Rooms, 70, Victoria Street, Westminster, Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

Capt. C. Barron, Mr. G. Burt, Assoc. Inst. C.E., Mr. R. A. Coates, Mr. J. W. Gallagher, and Mr. A. Krawehl, were elected Fellows.

Dr. W. N. Shaw, F.R.S., read a paper on "The Meteorological Aspects of the Storm of February 26–27, 1903," in the preparation of which he had been assisted by Mr. F. J. Brodie and Mr. R. C. K. Lempfert. Between sunset on the 26th and noon on the 27th of February the British Isles were visited by a storm of unusual severity. Its most impressive characteristic was the amount of damage done to trees and buildings by gales from the south or south-west, particularly in the neighbourhood of Dublin, where very large numbers of trees were uprooted, and in Lancashire. Gales or strong winds were also experienced in many other parts of the British Isles. [See *Symons's Met. Mag.*, March and April, 1903].

After exhibiting some lantern slides showing the path of the barometric minimum and the area over which the destruction extended, Dr. Shaw proceeded to put forward some general conclusions about barometric depressions and storms, dealing more especially with the distribution of winds and the velocity of travel. He said :—

"There is possibly some misapprehension as to what motion of air may be expected to take place in a travelling storm of normal and permanent type. I will therefore devote a few lines to the consideration of that question. The accepted representation of the instantaneous motion of air in the neighbourhood of a low-pressure centre is a combination of rotation and radial motion represented by spirals with a certain incurvature. The maps suggest that the air approaches the centre by essentially similar paths from all sides. This suggestion appears to me to be apt to lead to very serious misapprehension. The apparent spiral motion is a merely instantaneous representation of the state of motion of a number of bodies. The actual motion of the air in a travelling storm is not a symmetrical spiral motion of air masses towards a centre, but a complicated kind of dance figure, in which the dancers group themselves at any instant in such a way that they can be sorted into spirals; but the path of any individual dancer may, and generally does, make no real approach to the spiral form. The spiral motion only becomes complete if the storm centre becomes stationary, and the conventional diagram represents the true paths in that case; but when the incurvature is small and the velocity of travel great, the general resemblance to symmetrical spiral motion is lost. To simplify the preliminary consideration of the question on this occasion, I propose to neglect the incurvature and regard the instantaneous motion of the travelling storm as purely rotational. I wish to consider the actual motion of the component air under the circumstances indicated—in other words, the actual geographical path of a balloon floating in the air within the influence of the cyclonic disturbance. For ease of distinction I shall call the actual path of the air a 'trajectory,' reserving the use of the word path for the motion of

the storm centre. If the centre of the storm were stationary the balloon would be carried round in a circle, but if the storm centre moves the trajectory is not a circle but something entirely different.

"I suppose, further, as a special case, that the velocity of the wind is uniform over the area covered by the circular storm, and that the velocity of travel of the storm centre happens to be the same as the velocity of the wind. The trajectories will be of different shape according to the original positions of the points under consideration with regard to the centre and its path. A point in front of the approaching centre will start at right angles to the path, but will be overtaken by the advancing storm and have its direction of motion reversed before it has made a half circle, and in the rear of the storm it will find itself in the region of nearly parallel isobars and travel away from the line of the path. Its trajectory will be a curious hook-shaped curve. A point behind the centre will get into the region of the isobars approaching more and more nearly to parallel straight lines inclined to the direction of motion of the storm. Its trajectory will not differ much from a straight line inclined to the path. A point in the transverse line through the centre on the left of the path will gradually approach and cross the path in the rear and come into the concluding condition of the previous cases, while a corresponding point on the right of the centre will not have its direction of motion affected but will travel along always keeping the storm centre on its left. Its trajectory will be a straight line parallel to the path. No point moves in a circle or in anything approaching to it. The apparent simplicity of motion as represented on an isobaric map becomes therefore very misleading when we deal with the actual motion of air. The trajectories in any real case depend upon the velocity of the centre and the incurvature as well as the original position of the points, and hence they are a series of exceedingly complicated lines always combining to show a comparatively simple and symmetrical arrangement of velocities at any instant.

"For any particular case, assuming a certain distribution of winds and a velocity of travel, it is easy to construct a diagram showing the trajectories for a series of particles which at any particular instant take their places on a circular isobar. Such trajectories are of course, to a certain extent, hypothetical, but at least they approximate to the motion of air in a real cyclonic depression. We may distinguish two extreme types—first, Type A, the stationary storm with symmetrical incurvature, drawing its air equally from all sides; and secondly, Type B, the storm made up of winds of uniform velocity but varying direction which travels with the same velocity as one of its component winds."

Dr. Shaw was of opinion that the storm of February 26th-27th must be classed as belonging to the Type B.

A long and interesting discussion followed the reading of this paper, in which the President, Dr. A. Buchan, Mr. R. T. Omond, Col. H. E. Rawson, Mr. W. Ellis, Mr. F. J. Brodie, Mr. W. H. Dines, Dr. H. R. Mill, Mr. C. Harding, Capt. A. Carpenter, and Mr. W. Marriott took part, and Dr. W. N. Shaw replied.

The other paper communicated to the meeting was "The Dines-Baxendell Anemograph and the Dial-pattern Non-oscillating Pressure-Plate Anemometer," by Mr. J. Baxendell, F.R.Met.Soc. The Dines

Pressure-Tube Anemometer is now the accepted standard instrument for recording wind movement, but it does not record the direction of the wind. Mr. Baxendell has endeavoured to overcome this drawback, and in this paper he gave a description of the combined velocity and direction anemometer which he has designed for the Fernley Observatory at Southport. In addition, he has designed a non-oscillating pressure-plate for showing on a dial the maximum pressure of the wind. By using a combined "head" or vane for the Dines anemometer Mr. Baxendell has been able to arrange for the new instrument to record—(1) the velocity, (2) the direction, and (3) the maximum pressure of the wind.

THE SIX MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—June, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	+7·22	175	Arncliffe ...+	11·93	145	Braemar	+8·95	163
Tenterden	+2·74	125	Hull	+1·66	116	Aberdeen	+2·53	119
Hartley Wintney	+7·78	173	Newcastle.....	+1·41	113	Cawdor	+4·77	139
Hitchin	+8·49	188	Seathwaite +	19·91	134	Glencarron +	14·05	135
Winslow	+6·90	170	Cardiff	+5·47	134	Dunrobin	+1·78	113
Westley.....	+1·64	116	Haverfordwest	+6·31	136	Darrynane ...	+3·50	116
Brundall.....	+ ·16	102	Gogerddan ...	+4·49	125	Waterford ...	+6·91	141
Alderbury	+6·18	153	Llandudno ...	+4·27	136	Broadford.....	+5·31	137
Ashburton	+5·90	127	Dumfries ...+	10·29	154	Carlow	+7·20	149
Polapit Tamar ...	+5·30	135	Lilliesleaf	+6·65	152	Dublin	+3·34	129
Stroud	+7·72	167	Colmonell	+3·65	119	Mullingar.....	+5·78	136
Woolstaston	+6·52	152	Glasgow ...+	13·63	188	Ballinasloe ...	+5·33	134
Boston	+2·75	132	Inveraray ...+	10·70	134	Clifden	+2·29	107
Hesley Hall	+1·62	118	Islay	+4·57	124	Crossmolina ...	+5·91	126
Derby.....	+2·97	130	Mull	+6·23	126	Seaforde	+5·15	132
Bolton	+2·77	117	Loch Leven +	11·19	173	Londonderry..	+1·46	108
Wetherby	+5·97	158	Dundee	+2·23	119	Omagh	+7·53	145

The rainfall of the first six months of 1903 is above the average in all parts of the British Isles, and almost everywhere to a very substantial extent. Two extensive areas are particularly worthy of notice: the larger occupies the centre and south of Scotland and the north of England; the smaller occupies the central part of the south of England. In both the excess exceeds 50 per cent. of the average fall, and in both the excesses have the same maximum, both Hitchin and Glasgow having an excess of 88 per cent. The abnormal wetness of the winter months accounts for the condition of the northern area, that of the southern area is due mainly to the unprecedented character of June. Coast stations, both east and west, show the smallest excess of rainfall above the average.

REVIEWS.

The Cloud World, its features and significance, being a popular account of forms and phenomena, with an extended Glossary. By SAMUEL BARBER. London: Elliot Stock, 1903. Size $9\frac{1}{2} \times 6\frac{1}{2}$. Pp. xii. + 140. Illustrations.

THE author deals with clouds much in the same way as the field-naturalist deals with plants and animals. He describes their forms and what we may call their habits, dwelling upon the value of these characteristics as prognostics of coming weather. The scientific student of clouds or of air-movements, though he cannot fail to be interested in the observations which are detailed, will not be greatly helped, for the book was not written for him. The observer who loves observing for its own sake will find much to stimulate his interest in a fascinating avocation.

We cordially commend Mr. Barber's observations of the behaviour of clouds in exceptional circumstances to the attention of meteorologists. It would be well for the general reader to consult recent books on Meteorology to compare the impressions likely to be made by the portions of the text which border on theory with the views of other authors.

The pictures of clouds, most of them reproduced from *Knowledge* and many from the skilled camera of Captain Wilson-Barker, are a most attractive feature of the book.

U.S. Department of Agriculture. Report of the Chief of the Weather Bureau. 1900-1901. Size (vol. i.) 12 × 9. Pp. 318. Washington: 1901.

Ditto. 1901-02. Size 12 × 9. Pp. xxvi. + 342. Washington: 1902.

IN these reports only a few pages are devoted to the administration of the meteorological system; the bulk of the work is a discussion of the climatology of the United States for the year in question, mainly in the form of tables supplemented by explanatory statements.

With regard to the administration of the Weather Bureau, special attention is called to the efforts made to improve forecasts, and to secure the distribution of forecasts as widely and expeditiously as possible. Since the beginning of 1901 a new system of forecasts of Atlantic weather has been in use, whereby steamers leaving Europe are warned of the weather they are likely to meet in mid-Atlantic, and considerable success is claimed. A special caution is given to farmers who might be inclined to waste money by bombarding the sky in the hope of dissipating hail clouds; but, on the other hand, instances are cited in which damage from frost has been avoided by the timely use of smoke-producing combustibles in the fields on nights when a freezing temperature was predicted.

BOOKS RECEIVED.

The Meteorology of Edinburgh. By R. C. Mossman. [Trans. Roy. Soc. Edin., Vol. XL., Part III.] Edinburgh, 1903. Size 12 × 9½. Pp 41, one plate.

Survey Atlas of England and Wales. Part II. By J. G. Bartholomew. Edinburgh, 1903. Size 18½ × 12½. Five maps.

On the Similarity of the Short-period Pressure Variation over Large Areas. By Sir Norman Lockyer and W. J. S. Lockyer. [From Proc. Roy. Soc., Vol. 71.] Size 8½ × 5½. Pp. 2 and one plate.

Essai de Chronologie des Variations Glaciaires. Par M. C. Rabot. [Ex. du Bulletin de géographie historique et descriptive, No. 2.] Paris, 1902. Size 9½ × 6½. Pp. 47.

Researches with the Heliometer. Determination of the Parallax of the Ten First Magnitude Stars in the Northern Hemisphere. By W. L. Elkin. [Trans. Astronomical Obsy. of Yale Univ.] Size 12 × 9½. Pp. 72.

Meteorologisch Jaarboek voor 1900 & 1902. Utrecht, 1902. Size 12½ × 10. Pp. xxxvi + 262 and xxv + 242.

Meteorologiska Jakttagelser i Sverige. Vol. 39, 1897; vol. 40, 1898 and vol. 41, 1899. Stockholm, 1902. Size 12 × 10. Pp. viii + 157 and x + 155.

METEOROLOGICAL NEWS AND NOTES.

THE INTERNATIONAL KITE COMPETITION, held on the Sussex Downs, on June 25th, under the auspices of the Aëronautical Society of Great Britain, took place in fine weather but with a wind too light to enable the kites to rise 3000 feet, the minimum height for which the medal could be awarded. The kites, which were all worked by hand gear, were six in number. Each was loaded with a weight of 2 lbs. to represent a meteorograph and the greatest heights attained, as calculated from trigonometrical observations, were for Mr. Brogden's Burmese kite, 1816 feet; Mr. L. Cody's bird-shaped kite, 1476 feet; Mr S. F. Cody's similar machine, 1407 feet and Mr. S. H. R. Salmon's rhomboidal kite, 1250 feet.

WEATHER FORECASTS ARE UNNECESSARY in the opinion of a daily paper, published in a sea-side resort, which observes—whether in fun or in earnest we cannot say—

"For the pleasure-seeker, who can provide himself with a waterproof coat and umbrella, these reports are superfluous, and may be detrimental. The dwellers in our rough sea-girt island should never be influenced by considerations of weather. Townspeople when they want fresh air should take it without any attention to warnings. If it is mixed with *more hydrogen* than they desire they should suffer it patiently. It will be a bad day for England when a man or woman hesitates about going to the sea-side on account of the weather."

Some sea-side places seem, from the reference to hydrogen, to possess an explosive atmosphere.

THE THAMES FLOODS of last month caused a riverside resident to complain in the newspapers that he had taken his house because the river was at the bottom of his garden, but now he found that his garden was at the bottom of the river.

RAINFALL AND TEMPERATURE, JUNE, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	6·43	+ 4·53	1·48	14	10	85·9	28	39·7	13	0	
II.		Tenterden	3·56	+ 1·37	·79	10	10	83·5	28	37·5	13	0	
,,		Hartley Wintney	5·55	+ 3·60	1·02	15	9	83·0	28*b*	36·0	22	1	
III.		Hitchin	6·40	+ 4·62	1·75	14	8	84·0	29	38·0	14	0	
,,		Winslow (Addington)	5·17	+ 3·32	1·60	14	10	83·0	27	34·0	21	0	
IV.		Bury St. Edmunds (Westley)	3·11	+ 1·07	·75	13	6	86·0	28	36·0	13	0	
,,		Norwich (Brundall)	2·45	+ ·43	·68	15	10	86·0	28	34·8	13	0	
V.		Winterborne Steepleton	1·75	...	·58	19	11	77·6	1	33·5	22	0	
,,		Torquay	1·88	...	·54	19	14	76·2	1	43·5	22	0	
,,		Polapit Tamar [Launceston]..	1·80	— ·59	·68	9	11	73·1	27	36·8	22	0	
VI.		Stroud (Upfield)	4·12	+ 2·12	1·35	14	13	83·0	27	42·0	20	0	
,,		Church Stretton (Woolstaston)	3·16	+ 1·02	·96	14*a*	13	75·5	27	37·0	14*a*	0	
,,		Worcester (Diglis Lock)	2·90	+ 1·28	·83	10	15	...	...	...	...	...	
VII.		Boston	1·59	— ·09	·50	13	8	85·0	27	37·0	21	0	
,,		Hesley Hall [Tickhill].....	1·42	— ·25	·93	13	9	83·0	27	35·0	21	0	
,,		Derby (Midland Railway).....	1·26	— ·79	·45	13	8	81·0	27	37·0	20	0	
VIII.		Bolton (The Park).....	2·34	— 1·26	·65	26	9	71·5	27	35·1	21	0	
IX.		Wetherby (Ribston Hall) ...	2·48	+ ·39	·78	13	10	...	...	...	...	...	
,,		Arncliffe Vicarage.....	2·34	— 1·39	·83	26	11	...	...	...	...	...	
,,		Hull (Pearson Park).	1·74	— ·23	·99	13	8	81·0	28	39·0	21	0	
X.		Newcastle (Town Moor)	3·06	+ 1·18	·95	15	10	...	...	..	...	...	
,,		Borrowdale (Seathwaite).....	3·96	— 3·14	1·70	26	12	73·5	6	31·3	20	1	
XI.	WALES.	Cardiff (Ely).....	2·09	— ·24	·62	14	12	...	...	...	...	...	
,,		Haverfordwest	2·13	— ·20	·77	25	10	68·7	8, 27	35·9	21	0	
,,		Aberystwith (Gogerddan) ...	2·26	— ·38	1·05	10	8	77·0	27	28·0	19	3	
,,		Llandudno.....	1·11	— ·86	·38	15	10	70·0	23*c*	42·5	21	0	
XII.	SCOTLAND.	Cargen [Dumfries]	1·84	— ·88	·43	27	9	74·0	4	35·0	12	0	
XIII.		Edinburgh (Royal Observatory)	1·09	...	·37	4	11	74·2	4	39·7	18	0	
XIV.		Colmonell	1·99	— ·68	·59	27	9	77·0	8	34·0	20	0	
XV.		Tighnabruaich	2·60	...	·93	30	11	71·0	7, 10	38·0	19	0	
,,		Mull (Quinish).....	2·34	— 1·09	·69	30	10	...	...	...	...	...	
XVI.		Loch Leven Sluices	2·87	+ ·49	1·23	28	9	...	...	...	...	...	
,,		Dundee (Eastern Necropolis)	2·20	+ ·37	·55	27	17	79·0	4	36·3	14	0	
XVII.		Braemar	1·42	— ·91	·40	27	12	73·0	8	27·8	20	3	
,,		Aberdeen (Cranford)	1·59	— ·55	·42	27	12	73·0	28	30·0	18*d*	2	
,,		Cawdor (Budgate)	2·38	+ ·06	·52	4	18	...	...	...	...	...	
XVIII		Strathconan [Beauly]	1·19	— 2·32	.61	25	...	...	...	...	...	...	
,,		Glencarron Lodge.....	3·90	— 1·84	1·19	30	13	76·4	7, 8	30·9	20	1	
XIX.		Dunrobin	1·36	— ·68	·27	24	12	69·0	4	34·0	20	0	
,,		S. Ronaldshay (Roeberry) ...	...	...	...	...	...	...	...	...	...	...	
XX.	IRELAND.	Darrynane Abbey.....	4·12	+ 1·02	1·70	23	11	...	...	44·0	14	0	
,,		Waterford (Brook Lodge) ...	5·31	+ 2·70	1·89	25	10	73·0	5	35·0	21	0	
,,		Broadford (Hurdlestown) ...	1·33	— 1·08	·36	25	11	70·0	5, 27	38·0	13	0	
XXI.		Carlow (Browne's Hill)	3·15	+ ·88	·86	25	10	...	...	...	...	...	
,,		Dublin (Fitz William Square)	2·49	+ ·57	·84	22	13	72·7	28	41·0	14	0	
XII.		Ballinasloe	2·04	— ·61	1·02	24	13	73·0	7	35·0	20	0	
,,		Clifden (Kylemore)	2·32	— 3·11	·63	23	7	...	...	...	...	...	
XIII		Seaforde.....	2·97	+ ·41	1·34	22	12	86·0	28	35·0	18*e*	0	
,,		Londonderry (Creggan Res.).	·87	— 2·27	·19	22	9	...	...	...	...	...	
,,		Omagh (Edenfel)	1·95	— 1·06	·96	22	12	76·0	7	38·0	19	0	

+ Shows that the fall was above the average ; — that it was below it.

a and 15. *b* and 29. *c* and 28. *d* and 19. *e* and 20.

SUPPLEMENTARY RAINFALL, JUNE, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	5·41	XI.	Llandefaelog-fach.....	...
II.	Dorking, Abinger Hall .	5·19	,,	New Radnor, Ednol.....	3·69
,,	Sheppey, Leysdown	4·75	,,	Rhayader, Nantgwillt...	3·30
,,	Hailsham	2·44	,,	Lake Vyrnwy	1·30
,,	Crowborough.....	4·17	,,	Ruthin, Plâs Draw	1·68
,,	Ryde, Beldornie Tower..	2·17	,,	Criccieth, Talarvor	1·34
,,	Bournemouth, Kempsey	2·47	,,	I. of Anglesey, Lligwy..	1·78
,,	Emsworth, Redlands ...	2·22	,,	Douglas, Woodville.....	2·58
,,	Alton, Ashdell	4·06	XII.	Stoneykirk, Ardwell Ho.	2·92
,,	Newbury, Welford Park	6·00	,,	Dalry, Old Garroch	3·10
III.	Oxford, Magdalen Coll..	5·66	,,	Moniaive, Maxwelton Ho.	2·44
,,	Banbury, Bloxham	3·85	,,	Lilliesleaf, Riddell	1·48
,,	Pitsford, Sedgebrook ...	3·06	XIII.	N. Esk Res. [Penicuick]	2·00
,,	Huntingdon, Brampton.	3·60	XIV.	Dalry, Blair	3·21
,,	Wisbech, Bank House...	2·02	,,	Glasgow, Queen's Park..	1·74
IV.	Southend	5·87	XV.	Inveraray, Newtown ...	2·96
,,	Colchester, Lexden	3·16	,,	Ballachulish, Ardsheal...	3·87
,,	Saffron Waldon, Newport	5·71	,,	Campbeltown, Redknowe	1·55
,,	Rendlesham Hall	3·41	,,	Islay, Eallabus.....	·94
,,	Swaffham	2·37	XVI.	Dollar.....	2·76
V.	Salisbury, Alderbury ...	3·28	,,	Balquhidder, Stronvar...	3·38
,,	Bishop's Cannings	4·85	,,	Coupar Angus Station...	2·30
,,	Ashburton, Druid House	2·70	,,	Blair Atholl	2·25
,,	Okehampton, Oaklands.	2·66	,,	Montrose, Sunnyside ...	2·14
,,	Hartland Abbey	1·59	XVII.	Alford, Lynturk Manse..	1·86
,,	Lynmouth, Rock House	3·03	,,	Keith H.R.S.....	1·89
,,	Probus, Lamellyn	1·34	XVIII.	Fearn, Lower Pitkerrie..	1·51
,,	Wellington, The Avenue	2·81	,,	S. Uist, Askernish	1·54
,,	North Cadbury Rectory	3·03	,,	Invergarry.....	2·37
VI.	Clifton, Pembroke Road	3·74	,,	Aviemore, Alvie Manse.	2·10
,,	Ross, The Graig	2·81	,,	Loch Ness, Drumnadrochit	1·93
,,	Shifnal, Hatton Grange	1·31	XIX.	Invershin	1·45
,,	Wem Rectory	1·13	,,	Bettyhill	1·79
,,	Cheadle, The Heath Ho.	·85	,,	Watten H.R.S.....	·91
,,	Coventry, Kingswood ...	2·89	XX.	Cork, Wellesley Terrace	3·94
VII.	Market Overton	1·69	,,	Killarney, District Asyl.	2·27
,,	Grantham, Stainby	1·68	,,	Glenam [Clonmel]	2·92
,,	Horncastle, Bucknall ...	·88	,,	Ballingarry, Hazelfort...	2·05
,,	Worksop, Hodsock Priory	1·29	,,	Miltown Malbay	1·01
VIII.	Neston, Hinderton	1·34	XXI.	Gorey, Courtown House	4·06
,,	Southport, Hesketh Park	2·22	,,	Moynalty, Westland ...	1·46
,,	Chatburn, Middlewood.	2·32	,,	Athlone, Twyford	1·75
,,	Duddon Val., Seathwaite Vic.	2·96	,,	Mullingar, Belvedere ...	1·20
IX.	Langsett Moor, Up. Midhope	1·84	XXII.	Woodlawn	1·36
,,	Baldersby	1·71	,,	Westport, Murrisk Abbey	·83
,,	Scalby, Silverdale	1·75	,,	Crossmolina, Enniscoe ..	·94
,,	Ingleby Greenhow Vic..	4·14	,,	Collooney, Markree Obs.	·70
,,	Middleton, Mickleton ...	1·50	XXIII.	Enniskillen, Portora ...	2·35
X.	Beltingham	1·66	,,	Warrenpoint.....	2·02
,,	Bamburgh	2·35	,,	Banbridge, Milltown ...	1·23
,,	Keswick, The Bank.....	1·59	,,	Belfast, Springfield	2·05
,,	Melmerby Rectory	1·33	,,	Bushmills, Dundarave..	·72
XI.	Llanfrechfa Grange	2·68	,,	Stewartstown	1·64
,,	Treherbert, Tyn-y-waun	...	,,	Killybegs	1·35
,,	Castle Malgwyn	1·90	,,	Horn Head	·89

METEOROLOGICAL NOTES ON JUNE, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder: L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—After a brilliant day on the 1st, the temp. suddenly fell and no further warm weather was experienced until almost the end. A period of extraordinary wetness set in on the morning of the 9th, lasting till the night of the 19th, during which time 6·43 in., the whole of the month's R fell. This total has only been exceeded in June, 1878, with 6·71 in., and only on one other occasion in any month—namely, in August, 1878, with 6·72 in. On 13th, 14th, and 15th, the fall exceeded 1·00 in. in 24 hours. The mean temp. was 57°·6, or 2°·8 below the average, and the lowest in 46 years, except 56°·4 in 1860 and 56°·5 in 1871. The shade max. on 19th, 50°·8, was 2°·7 lower than the previous lowest value in June. T, L and H on 16th.

ABINGER HALL.—Fine till 8th and then extremely wet. Several frosts. TS on 16th.

TENTERDEN.—The first week was dry. From 8th to 19th was generally very wet. Cold, except for the first day and the last week, which were dry and hot. Duration of sunshine 195 hours.

CROWBOROUGH.—After the 1st, which was unusually warm, it was cool till 19th, and afterwards warm and dry. In 10 days, from 8th to 19th, 4·17 in. of R fell. On the night of 28th the min. temp. was 62°·9.

HARTLEY WINTNEY.—The greatest R ever recorded in any month, except October, 1891, when 7·07 in. fell. The first fortnight was cold, dull and cloudy; the second hot, dry and sunny.

WINSLOW, ADDINGTON.—The greatest June R ever registered at this station.

NORWICH, BRUNDALL.—A month of extremes. The 28th gave the highest June temp. in 21 years, and the 13th the lowest in the same period. The first 12 and the last 10 days were almost rainless, and nearly the whole month's fall occurred on the 8 days, 13th to 20th. The mean temp. was 2°·4 below the average of 20 years, and lower than any since 1886. L on 16th and 17th.

WINTERBORNE STEEPLETON.—Unusually cold. Mean temp. 53°·6, or 3°·0 below the average of 10 years. The excessive R of London and the Thames Valley did not extend to this part, and the R was less than the average.

TORQUAY, CARY GREEN.—R ·34 in. below the average. Duration of sunshine 215·9 hours, or 15·8 hours below the average. Mean temp. 56°·6, being 2°·2 below the average. Mean amount of ozone, 5·0; max. 8·0 on 22nd with S.E. wind, min. 3·0 on 5th with S.S.E. wind.

WELLINGTON.—Fine and warm at first. Weather changed on 8th, becoming very wet and at times abnormally cold till the 20th, when it improved. R about ·75 in. above the normal.

NORTH CADBURY RECTORY.—The first week and the last 10 days were fine and dry. From 8th to 20th was very gloomy with much R, though little compared with what fell round London. The 14th was the coldest June day by 8° in 7 years, and less warm than April 13th when there was S. Big H stones on 17th.

CLIFTON, PEMBROKE ROAD.—The first week was fine and warm, with high bar. and E. winds; from 8th to 16th very wet and cold, with R all day on 14th and 15th, the coldest days in June for 50 years. The last week was fine and warm with rising bar. R 1·40 in. above the average. TSS on 9th and 13th.

BOLTON, THE PARK.—During the first 20 days there were 19 on which the wind was E. or N.; this kept the temp. below its normal value, the lowest temp. in the screen being 35° and on grass 27°. Very little R fell until 24th and the three following days. The mean temp. was 53°·5, or 2°·5 below the average. Duration of sunshine 133 hrs. 20 mins.

SEATHWAITE VICARAGE.—A dry month, with persistently low night temp. and bright sunny days.

HULL, PEARSON PARK.—The earlier days were frequently cold, with N.E. wind and low night temp. Heavy R on 13th, 15th and 17th. T and H on 25th.

WALES AND THE ISLANDS.

LLANFRECHFA GRANGE.—Cold and ungenial after a hot week at the end of May. Fruit was much blighted by cold wind; the hay crop was very short and vegetation much retarded.

HAVERFORDWEST.—Unusually cold and inclement, with strong and persistent N. and E. winds throughout, reaching the force of a gale on the 1st and 2nd. Crops very backward and hay crop thin. Duration of sunshine 147·6 hours; three sunless days.

ABERYSTWITH, GOGERDDAN.—Very ungenial throughout, with heavy R and cold winds. Good weather in the last week, but too cold at night.

SCOTLAND.

CARGEN [DUMFRIES].—The dry weather of the first three weeks, accompanied by E. winds, most adversely affected the hay, corn and turnip crops.

INVERARAY, NEWTOWN.—Very fine and dry for the greater part of the month, but not warm, except for a few days at the beginning.

ISLAY, EALLABUS.—R only about one-third of the average.

MULL, QUINISH.—Absolute drought for 17 days from 5th to 21st, with brilliant sunshine. The first week of the drought was very hot and calm, but afterwards wind went to N. and E., with very cold nights. Sharp frost on 19th and 20th did much damage. This was the first frost in June since observations started 30 years ago. T and L on 29th.

COUPAR ANGUS.—The mean temp., 54°·7, was practically the average, but the extremes of 82° on 4th and 29° on 14th were unusual, and potatoes and the young leafage of the beech suffered much. Ground frosts occurred on 3 nights. R ·58 in. in excess of the average.

ALFORD, LYNTURK MANSE.—Notable for continuance of drought, the R being little felt till 19th and the ground fairly moistened only on 27th.

IRELAND.

CORK, WELLESLEY TERRACE.—R 1·15 in. over the average, and for the first 6 months of the year 7·50 in. over the average. The coldest June for 21 years except 1902; min. temp. on 14th, 34°·5, the lowest in June for 21 years.

DARRYNANE ABBEY.—Very dry to 20th, the fall being only ·11 in. on 3 days, followed by 3·72 in. on 5 days.

WATERFORD, BROOK LODGE.—The wettest June since 1879. T on 24th.

BROADFORD, HURDLESTOWN.—From May 17th to June 16th only 1·02 in. of R fell on 8 days, ·83 in. falling in a T8 on May 29th, during which ·80 in. fell in 20 minutes.

MILTOWN MALBAY.—Cold and very dry. From May 22nd until June 21st there was only ·11 in. of R, falling mostly in amounts of ·01 in. The June frosts did serious damage to the potato crop in low-lying bogs and bottoms, the cold black drought wilting and stunting all vegetation. All crag and stony lands were burned brown and water running scarce.

DUBLIN, FITZWILLIAM SQUARE.—Between 8th and 19th, rendered memorable by the torrential R in the south of England, only ·33 in. fell in Dublin, whilst in the week ending on 27th the fall amounted to 2·16 in. As in June, 1902, winds from Polar quarters prevailed throughout the greater part, but during the last 10 days S. winds were observed. Duration of sunshine 167·5 hours. Mean temp. 56°·4, or 1°·6 below the average. High winds were noted on 6 days, never reaching the force of a gale. L on 28th, and T8S on 14th, 24th and 28th.

BALLINASLOE.—Potatoes were damaged by frost on 20th. During a T8 on 24th ·90 in. of R fell in an hour.

MARKREE OBSERVATORY.—Very fine and dry almost throughout. Severe frost on the night of the 20th. T8 on 24th.

OMAGH, EDENFEL.—A favourable month, more than redressing the ill effects of the earlier months. During the first three weeks the weather was almost continuously fine, with occasional high temperatures, so that the heavy R of the last eight days was needed and welcome.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JANUARY, 1903.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, CamdenSquare	53·8	5	22·1	16	45·2	36·0	38·1	90	78·7	17·3	2·15	17	6·0
Malta	66·2	12	45·3	31	59·7	49·9	49·9	80	111·1	39·2	4·14	7	5·1
Lagos, W. Africa	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	91·7	7	51·1	26	76·0	59·0	55·0	64	...	...	1·81	8	3·0
Durban, Natal	95·0	28	61·4	15	86·5	69·0	...	...	152·3	...	2·44	18	6·2
Mauritius	89·0	10	66·6	1	86·0	73·4	72·3	80	160·0	63·4	9·26	18	7·1
Calcutta	84·1	26	48·9	1	77·9	57·7	56·8	69	135·1	42·7	·21	1	3·5
Bombay	86·6	7	61·5	27	81·7	67·8	63·2	69	133·5	52·7	·00	0	2·4
Madras	87·3	2	66·9	1	84·2	69·9	69·8	82	136·0	63·8	4·53	3	3·3
Kodaikanal	71·1	18	43·5	25	64·0	47·6	44·4	71	130·5	28·7	1·25	3	3·8
Colombo, Ceylon	92·8	24	73·0	7	89·2	74·1	72·3	80	155·0	71·0	4·16	9	5·3
Hongkong	73·8	26	46·2	10	63·0	54·2	48·0	68	123·5	...	1·37	8	7·3
Melbourne	105·0	31	48·8	22	77·3	55·5	50·9	63	162·0	40·2	·94	4	4·7
Adelaide	102·3	31	51·9	14	84·1	60·6	50·8	47	159·0	47·0	·87	5	3·0
Coolgardie	113·4	27	49·2	21	96·2	64·4	48·5	33	173·6	47·0	·24	3	1·9
Sydney	89·1	6	57·3	15	77·3	64·6	59·6	65	132·7	49·9	2·28	14	4·4
Wellington	78·5	25	42·0	30	66·7	52·5	48·7	66	132·0	32·0	3·86	18	5·7
Auckland	76·5	7	52·0	30	68·9	57·2	50·3	63	145·0	50·0	7·13	19	5·4
Jamaica, Negril Point	87·9	13	62·2	18	84·0	69·5	69·2	78	...	...	1·13	5	...
Trinidad	90·0	19	61·0	16	86·9	67·5	69·8	78	160·0	60·0	1·51	3	...
Grenada	86·2	9	76·2	26	82·3	72·5	68·7	72	151·0	...	5·09	21	2·8
Toronto	43·9	30	—4·9	9	29·8	16·3	21·4	84	54·0	—9·1	2·70	18	7·8
Fredericton, N.B.	45·9	22	19·5	11	26·8	3·7	4·7	61	...	...	3·96	10	6·0
Winnipeg	35·0	25	—28·7	30	13·6	—9·1	...	...	...	...	·28	3	5·5
Victoria, B.C.	54·0	3	30·3	28	45·2	38·6	...	...	...	...	3·94	20	8·3
Dawson	14·2	13	—60·8	26	-19·6	—33·5	...	...	...	...	·50	2	4·5

MALTA.—Mean temp. of air 54°·3, or 1°·1, above average. Mean hourly velocity of wind 8·4 miles, or 2·9 below average. Mean temp. of sea 60°·2.

Mauritius.—Mean dew point 2°·0 above, and R 2·03 in., above average. Mean hourly velocity of wind 8·4 miles, or 2·7 below average; prevailing direction E. by S.

MADRAS.—Bright sunshine 185·2 hours, or 52·4 per cent. of the possible maximum.

KODAIKANAL.—Mean temp. of air 54°·0. Mean daily velocity of wind 287 miles. Bright sunshine 203·0 hours.

COLOMBO.—Mean temp. of air 80°·7, or 1°·6 above, of dew point 2°·4 above, and R ·65 in. above, averages. Mean hourly velocity of wind 7·9 miles.

HONGKONG.—Mean temp. of air 58°·3. Bright sunshine 107·3 hours. Mean hourly velocity of wind 11·8 miles; prevailing direction E.N.E.

Adelaide.—Mean temp. of air 72°·4, or 1°·7 above average.

Wellington.—Mean temp. of air 1°·5 below, and R 1·45 in. above, averages.

Auckland.—Unprecedentedly cool and wet, R being the largest yet recorded for the month, and nearly three times the average. Mean temp. 4° below average.

TRINIDAD.—R 1·45 in. below the 40 years' average.

SYMONS'S

METEOROLOGICAL MAGAZINE.

No. CCCCLI.] AUGUST, 1903. VOL. XXXVIII.

HEAVY FALLS OF RAIN IN JULY, 1903.

A REMARKABLY wet July following a remarkably wet June has made it quite clear that the year 1903 is to have a rainfall much above the average in the south of England at least. As in June so in July, the heavy rain has not been accompanied by thunderstorms of remarkable severity, though electrical disturbances have not been absent. The most striking features of the July rainfall have perhaps been the very high falls which occurred in the north of Kent on Thursday, the 23rd, and the heavy rain in London on the early morning of Sunday, the 26th, when several of the newspaper offices were flooded and the printing of the Sunday papers stopped.

The monthly falls, with the difference from the average as well as the aggregate excesses of rainfall for the year, will be found set forth in detail in the Tables. We may mention that at Camden Square there were five days with a rainfall exceeding one inch between June 13th and July 23rd, and in only one previous year, in 1878, has so great a number of rainfall days with falls of one inch or over been recorded. Between June 13th and July 25th there were no less than seven days with a rainfall exceeding three-quarters of an inch, and by July 31st the rainfall from January 1st amounted to 22·04 in., whereas in 1902 the total fall for the year was 20·84 in., and the average yearly fall for the ten years, 1890-99, was 22·78 in. Since the Camden record commenced in 1858 there has been no previous instance of two consecutive months with over 5 inches of rain each, nor of so great a fall as 11·63 in. in any two consecutive months.

As regards the exceptionally heavy falls, we cannot do better than let our correspondents speak for themselves. The first of the following letters refers to the 19th; all the others to the 23rd.

To the Editor of Symons's Meteorological Magazine.

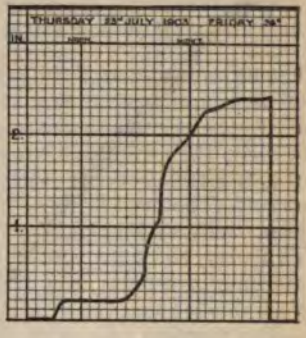
As a regular yearly correspondent of yours in the matter of rainfall, I think it will be of interest to you if I send a report of the most remarkable storm I ever witnessed in England. Dense masses of clouds appeared to come from all sides at 4.30 p.m. on July 19th. The storm began, the lightning was almost continuous, and in 30 minutes, when there was a lull in the storm, I measured 1·68 in. of rain; within a quarter of an hour it began again, and in a little over

half-an-hour a further fall of 1·53 in. The storm then passed away towards the S.E. Altogether **3·21** inches of rain fell in about one hour and a half. Several trees were struck, and I had two heifers killed and one injured by the lightning not far from my house; they were under a tree that was struck.

J. G. WOOD.

Shaldon Manor, Alton, Hants,
20th July, 1903.

The heaviest rainfall which has occurred on the summit of Crowborough Hill since the commencement of my residence there at the end of the year 1889 is recorded on the enclosed copy of my rain gauge diagram. The fall commenced at 9 o'clock on Thursday morning, 23rd July, when two-tenths of an inch fell in one hour; then there was a cessation from 10 o'clock a.m. till 5 o'clock p.m., when the rain recommenced, and fell continuously till 5 o'clock a.m. on Friday, the 24th, by which time 2·25 inches additional rain had fallen, thus showing that **2·45** inches had fallen in 14 hours.



Each vertical line represents one hour, each horizontal line ·10 in.

ISAAC ROBERTS.

Starfield, Crowborough,
27th July.

On the morning of the 24th my gauge measured **2·48** in., 13½ hours rain. We had neither thunder nor wind; the heavy black clouds seemed to pass from east to west. This is a record for

J. MASSON.

Tottingworth Park, Heathfield, Sussex,
July 26th, 1903.

I registered no less than **2·79** in. this morning, which fell in 17 hours. So far as I know, this is unprecedented for this locality.

C. E. JONES.

9, Manor Terrace, Lea Bridge Road, Leyton, E.
July 24th, 1903.

The rainfall here for 24 hours ending 10 a.m. July 24th, has been **2·85** in., the result of heavy showers in the morning and 15 hours continuous rain, from 4.30 p.m. July 23rd to 7.30 a.m. July 24th. I thought the amount sufficiently remarkable to notify to you.

M. BOARDMAN.

Glen Andred, Groombridge, Sussex,
July 24th.

I registered this morning at 9 a.m. **2·89** in. Rain began about 4 p.m., and at 7 p.m. 0·25 in. had fallen. A tropical rain fell from about 7.30 to 9.30, and heavy rain till daylight. Rain ceased about 8.30 a.m.

FREDERICK WILKIN.

Lower Cousley Wood, Sussex, 24th July, 1903.

The rainfall, as measured by myself here, for 24 hours ending 9 a.m., 24th inst., was **3·02** in. Rain started at 6.45 p.m., 23rd, but only fell in any quantity after 7.15 p.m.

Measurements were at		
23rd	7.15 p.m.	·01 in.
	8.15 p.m.	·53 ,,
	9.15 p.m.	1·04 ,,
	10.15 p.m.	1·49 ,,
24th	9 a.m.	3·02 ,,

The rain ceased practically on the stroke of 9 a.m.

F. W. FREIR.

Bylock Hall, Ponders End, Middlesex, July 25th, 1903.

I have to inform you that the rainfall for 24 hours ending 9 a.m. this day, amounted to no less than **3·11** in. The rain overflowed the receiver (which holds 2·90 in.) into the large cylinder. The rain occurred from 10 a.m. till noon, and from 5 p.m. to 6.30 a.m. on 24th.

I. C. STENNING.

Steel Cross House, Tunbridge Wells, 24th July, 1903.

I registered **3·38** in. of rain here for the period 5.40 p.m. on 23rd to 8 a.m. on 24th. As a rule our rainfall is small on board the ship. On this occasion it came down in torrents. I had been in town and coming back, just on this side of Dartford, the embankment had washed down and blocked the lines; they managed, however, to clear one line, over which all trains, up and down, had to pass slowly.

D. WILSON-BARKER.

H.M.S. Worcester, off Greenhithe, Kent, July 24th, 1903.

The amount of rain measured at 9 a.m. to-day (July 24th) for the preceding 24 hours totalled **3·42** inches. This amount is almost unprecedented so far as London and its neighbourhood are concerned, the nearest approach, as far as I have been able to ascertain, being 3·28 in. at Camden Square on 23rd June, 1878. The fall of rain was heaviest from 6.30 to 10.30 p.m. on July 23rd, during which time the amount was 2·31 inches.—At Greenwich Observatory (distant ¾ mile W.N.W.) the total fall was **3·15** inches. There was some thunder and lightning between 7.15 and 7.45 p.m. on the 23rd.

H. K. G. ROGERS.

13, Eastcombe Villas, Blackheath, S.E., 24th July, 1903.

We are surprised to see so little in the papers about the heavy rainfall we measured in this district on Thursday. You may be interested to know that we had **3·28** in. My brother, living three miles off (nearer Gravesend) measured **3·75** in., and a friend at Thorney, near Gravesend, **3·84** in. In our own case, ·53 in. fell between 11 a.m. and 1.30 p.m. We had a fine afternoon, but it began to rain again at 6 p.m. and kept up a continual downpour until about 9 a.m. on Friday. We only measured ·02 in. for Friday. I believe they had between 2 and 3 inches at Frindsbury. Thunder was heard on Thursday morning, but very distant.

FRANCES PYE.

Knight's Place, Rochester,
July 25th, 1903.

This morning at 9 o'clock I measured the exceptional amount of **3·94** inches of rain, being the quantity for previous 24 hours. The greater portion fell between 6.30 and 9 p.m., but I believe that it rained all night and was raining slightly at 9 o'clock this morning. There was a little thunder last evening. I may say that I measured *most* carefully (twice), taking all precautions to avoid error. My gauge holds 4½ inches.

LIONEL BURRELL.

Westley, Sidcup,
July 24th, 1903.

[Dr. Burrell is to be congratulated on his prudence in having a gauge large enough to contain so exceptional a fall. Another observer at Sidcup spoiled his record for the year and lost the satisfaction of noting a great fall, by having so small a receiver that his gauge overflowed with 2·50 in., an amount which any summer thunderstorm might deposit in an hour.]—Ed. *S.M.M.*

SCOTTISH METEOROLOGICAL SOCIETY.

THE Half-yearly General Meeting of the Society was held in the Hall of the Royal Scottish Society of Arts, 117, George Street, Edinburgh, on July 18th, Lord MacLaren, Vice-President, in the chair.

The report of the Council, which indicated that the affairs of the Society were in a satisfactory condition, was adopted.

Dr. Buchan read a paper on "The Rainfall of Scotland in relation to Sunspots." A set of eleven maps was exhibited, showing the variations for each of 144 Scottish stations most of which had practically continuous records from 1855 to 1898, that is for four eleven-year sunspot periods. The amounts for each station for the years 1855, '66, '77, '88 were grouped together, those for 1856, '67, '78, '89, and so on. Each of these eleven groups of four years was averaged, and the deviations of each from the 44-years' mean were entered as percentages on the corresponding maps. The broad results were of

a striking character, the year following that of sunspot maximum being a year of decided rainfall excess, whilst there was a tendency to a secondary maximum about the time of sunspot minimum. The different stations all over the country confirmed one another in a remarkable manner, but this variation was more pronounced for places on the west coast than for places on the east. Combining and averaging the results for all the stations dealt with, the following curve for "all Scotland" was obtained :—

Year of cycle	i.	ii. (*min.*)	iii.	iv.	v.	vi. (*max.*)	vii.	viii.	ix.	x.	xi.
Per centage under or above average of 42·6 inches ...	−3	−2	−5	−4	−3	+4	+7	+7	+1	−1	—

The time of rainfall maximum corresponded to a period of excess of winds with a westerly component.

The results presented referred to Scotland only. An examination, for instance, of the rainfall of the south-eastern counties of England showed that there the curve was inverted, the principal maximum occurring at the time at which the secondary maximum occurred in Scotland. The curves for the different countries of the world must be studied in relation to the varying meteorological conditions of different regions.

Lord MacLaren made some remarks on the nature of sunspots. The double maximum suggested that two influences were in operation. Perhaps there was a double variation, one of rainfall intensity and one of rainfall frequency. Sir John Murray emphasized the cumulative effect of the causes at work by which the year of rainfall maximum was deferred till the year following that of maximum sunspots.

Mr. R. T. Omond, the hon. secretary, followed with a paper on "The Location of Rainfall Stations in Scotland." From the scientific point of view it was desirable to know with equal accuracy the amount of rain that fell on each small portion of the country ; but a map on which were entered all places from which records were available showed lamentable blanks in most of the mountainous or thinly populated districts. The Council, therefore, appealed to members to aid them in an endeavour to secure additional rainfall observers, especially in the Southern Uplands, the Western Highlands and the extreme North.

OBSERVING THE FALL OF A METEORITE.

REFERRING to a note in our February number, stating that meteoric stones had been seen to fall only four times in the British Isles, the Rev. W. C. Plenderleath, of Mamhead Rectory, writes stating that he had heard of another case, and sending an account of it written by the lady who saw the phenomenon. In the absence of a mineral-

ogical examination of the stone it is impossible to say positively that it was a meteorite and not a piece of ironstone struck by the flash of lightning which fused the sand. The description runs :—

"With pleasure I write all I remember of the incident referred to in Mr. Plenderleath's letter, and I will make it as clear as I can. In 1887 (I think early in August) there was a very heavy thunderstorm at Harrogate, and in the surrounding districts. We were then living at Starbeck, a hamlet between Harrogate and Knaresborough. I was watching the storm from the drawing-room window, when suddenly (simultaneously with a sharp, cracking clap of thunder, immediately overhead) I saw a bright white light fall, in a flash of lightning. As it touched the earth I heard a loud fizz—like an enormous match being struck. When the rain ceased I went to the spot where it fell, in a meadow, at the bottom of the garden, about 50 yards distant. I saw a disturbance in the ground, and on digging at a little below the surface, I found a hard, heavy substance, about the size of a guinea-fowl's egg, surrounded by pieces of light grey and white substance, like slate. I collected it all and sent it to Professor Tyndal ; by return of post I had a kind note from Mrs. Tyndal, saying that the Professor was from home, but that she had notified him. In a few days I heard from Professor Tyndal, thanking me for the specimen, and saying that it was 'ironstone,' and the fragments 'fusion of sand by the lightning.' Dr. Tyndal did not return the specimens, and I do not know what became of them. My husband's health was very bad, and we left for the east, and Japan, immediately afterwards, and the meteorite passed from my mind, interesting though it was. I was seven years absent from England. It is a long time ago now, nearly sixteen years, and so much has happened since—but I always remember the interesting circumstance, and feel rather proud to have seen and found it. I wish I could tell what became of it."

Abraham Follett Osler.

1808—1903.

THE death of Mr. James Glaisher, at the advanced age of 93, has been quickly followed by that of his still more patriarchal contemporary, Mr. A. F. Osler, F.R.S., who, although less known to the public, was a notable figure in the meteorological world of the first half of the last century. Mr. Osler devised the self-recording pressure-plate anemometer and rain-gauge with which his name is associated, in the year 1837, and, although for purposes of exact measurement the instrument in its original form has been superseded by Mr. Dines's pressure-tube anemometer, it exercised a very important influence on the growth of our knowledge of the force of the wind. These anemometers were used at the temporary observatories at St. Helena, Toronto and the Cape of Good Hope during Ross's Antarctic expedition of 1839-43. Mr. Osler was engaged in business in Birmingham, and the first of his anemometers to be constructed has, we believe, been at work in the observatory of the Birmingham and Midland Institute for sixty-six years.

Correspondence.

HEAVY FALLS OF RAIN IN SHORT PERIODS.

To the Editor of Symons's Meteorological Magazine.

On page 78 of your Magazine for June I note that Mr. F. Campbell Bayard records some phenomenal short period rainfalls, of which the most remarkable is that of Beddington Corner—3·50 in. in less than an hour.

The greatest fall I have ever registered was during a thunderstorm in North Sussex on June 7th, 1889, when 2¼ inches fell in 1½ hours. This is at the rate of 1·50 in. per hour, or considerably less than half that recorded by Mr. Campbell Bayard. In *British Rainfall*, 1886, p. 117, I see there are three remarkable falls within the last 30 years of half an hour and less, viz. :

2·12	inch at	Canterbury	in 20 minutes.
2·34	,, at	Camden Square	in 30 ,,
2·90	,, at	Glamorgan	in 30 ,,

But I fail to find any record to equal 3½ inches in less than an hour, and shall be glad to know whether this is a record for Surrey.

Yours faithfully,

ARTHUR F. PARBURY.

Jesses, Haslemere, Surrey, 17th June.

[The measurement of the rate of rainfall is of great importance, but it has been much neglected, and until self-recording rain gauges are much more frequently used than at present we must remain with very imperfect information. Although very heavy falls of rain in short periods have rarely been measured, it is not safe to conclude that they rarely occur, for their apparent rarity may be due merely to the small number of observers who are on the watch for them.

So far as we can ascertain by consulting the volumes of *British Rainfall*, the fall of 3·50 in. of rain in one hour at Beddington Corner, on May 30th, 1903, is the greatest amount ever recorded in one hour in the British Isles with one exception, 3·63 in. having fallen in one hour at Maidenhead in 1901. In 1889 a fall of 3·64 in. in 1 hr. 5 min. (at the rate of 3·36 in. per hour) took place at Henley-in-Arden ; in 1901 a fall of 3·25 in. in 55 minutes (at the rate of 3·55 in. per hour) was reported from Wadhurst, and in 1900 a fall of 3·75 in. occurred at Ilkley in 1 hr. 15 min. (at the rate of three inches per hour). We have found no other case of a continuous rain for more than 55 minutes at an average rate of 3 in. per hour. For shorter periods, of course, far greater intensities are on record. Thus, in 1893, a fall of 1·25 in. took place in five minutes at Preston, the rate being 15·00 in. per hour. The diagram published annually in *British Rainfall* shows that in order to be exceptional an hour's rain must exceed 1·75 in., a half-hour's 1·25 in, a quarter-hour's ·80 in., and five minutes' fall ·30 in. ; these values corresponding respectively

to 1·75 in., 2·50 in., 3·20 in., and 3·60 in. per hour. We trust that the attention called to this matter by Mr. Parbury may induce many observers to observe the duration of exceptionally heavy showers, and read their gauges as soon as the shower is over.—ED., *S.M.M.*]

PREVALENCE OF MACKEREL SKIES IN THE LATTER PART OF JUNE.

To the Editor of Symons's Meteorological Magazine.

I WAS much struck by the prevalence, during the latter part of June, of what Abercromby, in his treatise on Weather, calls one of the rarest skies seen, viz., mackerel. From June 25th to 30th a distinct mackerel sky was visible during some period of the day. At 7.30 a.m. on the 27th, a really beautiful mackerel sky was visible of a pearly white colour at the zenith; when first observed it was of a minute cumuli-form appearance, it gradually changed between 7.30 and 7.45 a.m., first into wavelets and then into flecks, and by 8 a.m. it had assumed the appearance of an almost perfect scale cloud. A still more beautiful instance was seen on the 28th at 8.30 p.m.; this cloud was of a dark minute cumuli-form appearance, tinged a glowing golden red, set in a golden yellow background, the contrast being very fine. On the same evening, towards 9.30 p.m., cirro-stratus was visible in the W.N.W.; it appeared to hang in the sky like a pall of smoke on a calm day, and was tinged a peculiar brick-dust tint round the edges.

S. C. RUSSELL.

"*Dunrobin*," *Cedar Road, Sutton, Surrey,*
July 3rd, 1903.

REVIEWS.

Report of the Meteorological Council for the year ending 31st March, 1902, to the President and Council of the Royal Society. London. Printed for H. M. Stationery Office, 1902. Size 9½ × 6. Pp. 164. Price 1s. 2d.

THIS report, though dated on the cover 1902, was not in the hands of the public in that year. Of the new work taken up by the Council, we may notice the preparation of the meteorological reports for the Registrar-General, a work which had for many years been carried out by the late Mr. Glaisher. The Council supplied meteorological instruments to the Antarctic Expedition on board the *Discovery*, and opened a new statistical department in the largest and most accessible room in the Meteorological Office, where the public may consult the records preserved there. Other desirable extensions of the work of the Office are referred to, and regret expressed, which will meet with general sympathy, that they are at present impracticable, on account of the full occupation of the staff in other duties which cannot be set aside.

The weather forecasts for the year were rather more successful than usual, 58 per cent. of complete and 26 per cent. of partial successes being claimed, as compared with an average of 55 and 27. The special storm warnings were as usual rather better, 62 per cent. being completely, and 26 per cent. partially justified.

The report on the Climatological stations shows a satisfactory increase in the number of sunshine records. Appendix V. contains a summary of the conspicuous meteorological occurrences of 1901, and maps are given of the distribution of rainfall during the heavy falls of November 11th and 12th, showing the relation of the rainfall to barometric pressure and wind.

This report seems to exhale a spirit of hopefulness, and we trust that facilities may be afforded the Meteorological Office to carry out the new work hinted at or already begun.

Theory of Observations. By T. N. THIELE, Director of the Copenhagen Observatory. London: C. and E. Layton, 1903. Size $10\frac{1}{2} \times 8\frac{1}{2}$. Pp. 144. Plate. Price 12s. net.

THIS is a discussion of the theory of observations, dealing in a comprehensive way with the laws of error and probability. The treatment of every collection of statistics necessarily involves the application of these laws either designedly or implicitly, but it would be impossible in this place to follow Mr. Thiele's systematic development of the subject which is treated in a purely general way with much mathematical detail. We must congratulate the author on his admirable command of the English language, his clear and graceful use of which makes the memoir pleasant to read and the reasoning easy to follow.

Quarterly Return of Births, Marriages and Deaths for England and Wales. Published by the Authority of the Registrar General. London: April 28th, 1903. Price 9d.

WE notice this well-known official publication, because the first quarter of 1903 contains the first issue of the meteorological tables compiled by the Meteorological Office. These are preceded by remarks on the weather, extracted from the Monthly Weather Reports, and the tables themselves contain data from sixty-one stations in England, Wales and the English Channel. The stations are grouped into eight districts, and are selected so as to represent the various meteorological conditions of each district with regard to distance from the sea, height above sea level, and relation to aggregation of population as well as to uniformity of geographical distribution. With so small a number of stations scattered over so large an area the attempt to take account of all the factors specified is a bold one, but it is an attempt in the right direction, and we are not rash enough to say that we could improve upon it. Unfortunately

uniformity in recording has not yet been attained. Some stations only give the readings once daily at 9 a.m., some are taken at 8 a.m. and 6 p.m., others at 9 a.m. and 3 p.m., but these are distinguished by the use of special type from the majority of the stations, which have readings for 9 a.m. and 9 p.m., and the latter alone are used for estimating the mean values for the eight districts. The scientific value and practical utility of the tables have been distinctly increased by the changes which have been made.

The National Physical Laboratory. Report for the Year 1902. London: Harrison and Sons. 1903. Size 10½ × 7. Pp. 52.

A PROMPT report of work done, including as an appendix a record of the magnetic and meteorological observations at Kew Observatory. As showing the value of the Kew verifications and the excellence of the work of leading opticians, we note that out of 2733 meteorological thermometers tested in 1902, only 55 were rejected on account of excessive error or for other reasons; thus 98 per cent. of the thermometers submitted were of high accuracy.

Rapport sur les Observations Internationales des Nuages au Comité International Météorologique, par H. HILDEBRAND HILDEBRANDSSON. I. Historique: Circulation Générale de l'Atmosphere. Upsala, 1903. Size 10½ × 7½. Pp. 44 and 22 plates.

PROFESSOR HILDEBRANDSSON of Upsala first describes the steps by which the International Meteorological Committee were induced to organize systematic observations of clouds in all parts of the world. One result of this was the adoption of an international nomenclature for clouds and the preparation of the well-known international cloud atlas. Another result was the observation of cloud movement, especially the movement of the upper clouds, at a number of stations in all parts of the world.

The second and larger part of the report is devoted to the discussion of the observations which have been collected, and this is illustrated by plates showing the average cloud-directions at each station for each month in the year. The conclusions arrived at are so important that we translate them in full.

"We have proved *by direct observations* the following results:—

"1. Above the thermal equator and the equatorial calms an air-current prevails from the east all the year round and at great heights it appears to have a high velocity.

"2. Above the trade winds there prevail anti-trades blowing from S.W. in the northern hemisphere, and from N.W. in the southern.

"3. These upper anti-trades do not blow beyond the limits of the surface trade winds, but are deviated more and more to the right in the northern hemisphere and to the left in the southern, until they become westerly winds above the tropical high pressure belts, where they descend to supply the surface trades.

"4. The regions situated near the equatorial limits of the trade winds lie according to season in the trades or in the equatorial calms, and consequently above them there is an upper monsoon, consisting of the anti-trade in winter and the equatorial current in summer.

"5. From the tropical high pressure belts the pressure of the air diminishes regularly, on the average, towards the poles or at least to within the polar circles. Thus the air of each temperate zone is drawn into a great polar whirl, turning from west to east. The circulatory movement seems to be of the same nature as that of an ordinary cyclone; the air of the lower layers approaches the centre and that of the upper retires from it more and more as the height increases up to the highest regions in which we have cloud observations.

"6. The upper layers of air of the temperate zones extend over the tropical high-pressure belts in order to descend there.

"7. The irregularities found at the surface, especially in the region of the Asiatic monsoons, in general disappear at the height of the lower or intermediate clouds.

"8. It is necessary to abandon the idea of a vertical circulation of air between the tropics and the poles hitherto admitted according to Ferrel and James Thomson."

These results are a statement of observed facts as to cloud movement and are in no way theoretical. The author points out in addition that the direction of the upper air-currents seems to coincide with the average paths of barometrical depressions which may originate as satellites in the great atmospheric currents.

THE SEVEN MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—July, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	10·17	186	Arncliffe ...+	11·94	138	Braemar	+9·60	156
Tenterden	+3·81	128	Hull	+2·02	116	Aberdeen	+5·17	132
Hartley Wintney	+8·82	168	Newcastle.....	+3·45	126	Cawdor	+4·98	131
Hitchin .....+	10·24	185	Seathwaite +	20·75	131	Glencarron +	13·96	130
Winslow	+7·90	164	Cardiff	+6·81	136	Dunrobin	...	...
Westley.....	+2·55	119	Haverfordwest	+6·72	132	Darrynane ...	+4·13	116
Brundall.....	+2·66	120	Gogerddan ...	+5·96	128	Waterford ...	+7·16	135
Alderbury	+6·59	147	Llandudno ...	+4·25	129	Broadford.....	+6·92	140
Ashburton	+7·79	131	Dumfries ...+	11·96	154	Carlow	+8·83	150
Polapit Tamar ...	+5·82	132	Lilliesleaf	+8·09	152	Dublin	+4·78	133
Stroud	+9·00	164	Colmonell.....	+3·94	118	Mullingar.....	+7·94	141
Woolstaston	+7·32	149	Glasgow ...+	14·33	178	Ballinasloe ...	+6·64	135
Boston	+3·16	130	Inveraray ...+	10·29	128	Clifden	+2·27	106
Hesley Hall	+1·88	117	Islay	+4·91	122	Crossmolina ...	+7·28	128
Derby.....	+2·86	123	Mull	+7·12	125	Seaforde	+6·88	136
Bolton	+2·44	112	Loch Leven +	13·53	174	Londonderry..	+2·64	113
Wetherby	+6·92	155	Dundee	+4·27	130	Omagh	+8·34	141

RAINFALL AND TEMPERATURE, JULY, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	5·20	+ 2·95	1·33	17	13	87·2	10	45·2	8
II.		Tenterden	3·67	+ 1·07	1·17	23	16	83·4	11	40·5	8
,,		Hartley Wintney	3·40	+ 1·04	·70	23	15	85·0	10	44·0	28*b*
III.		Hitchin	4·16	+ 1·75	1·36	23	15	82·0	10	41·0	7
,,		Winslow (Addington)	3·47	+ 1·00	·80	23	14	86·0	10	41·0	8
IV.		Bury St. Edmunds (Westley)	3·82	+ ·91	1·47	23	15	86·8	10	40·0	8
,,		Norwich (Brundall)	5·37	+ 2·50	2·28	23	19	83·2	10	40·4	21
V.		Winterborne Steepleton	4·52	...	1·80	25	15	79·1	10	39·5	14
,,		Torquay	3·62	...	·80	25	15	76·2	10	48·3	14
,,		Polapit Tamar [Launceston]..	3·54	+ ·52	·68	16	16	78·1	11	39·1	14
VI.		Stroud (Upfield)	3·89	+ 1·28	1·31	21	16	79·0	2	47·0	7
,,		Church Stretton (Woolstaston)	3·13	+ ·80	·90	19	19	78·0	10	47·0	8, 9
,,		Worcester (Diglis Lock)	3·35	+ 1·59	·92	18	19	...	...	...	...
VII.		Boston	2·53	+ ·41	·60	23	14	90·0	10	40·0	8
,,		Hesley Hall [Tickhill].....	2·23	+ ·26	·41	11	14	86·0	10	40·0	8
,,		Derby (Midland Railway).....	2·20	— ·11	·52	25	15	86·0	10	42·0	7
VIII.		Bolton (The Park).....	3·77	— ·33	·77	14*a*	17	77·0	2	43·9	8
IX.		Wetherby (Ribston Hall) ...	3·24	+ ·95	·85	11	18	...	...	...	...
,,		Arncliffe Vicarage.....	5·04	+ ·01	·92	14	18	...	...	...	...
,,		Hull (Pearson Park).	2·68	+ ·36	·58	14	16	86·0	10	41·0	8
X.		Newcastle (Town Moor)	4·73	+ 2·04	·80	14	16	...	...	...	...
,,		Borrowdale (Seathwaite).....	10·25	+ ·84	2·32	6	18	75·8	2	44·4	7, 8
XI.	WALES.	Cardiff (Ely).....	4·58	+ 1·34	1·09	29	18	...	...	...	...
,,		Haverfordwest	3·75	+ ·41	1·02	21	18	75·6	10	45·4	13
,,		Aberystwith (Gogerddan) ...	5·09	+ 1·47	1·28	21	15	80·0	9	...	...
,,		Llandudno.....	2·56	— ·02	·41	14	17	80·0	2	49·0	2, 7
XII.	SCOTLAND.	Cargen [Dumfries]	5·01	+ 1·67	1·74	14	14	76·0	2	40·0	7*c*
XIII.		Edinburgh (Royal Observatory)	3·82	...	1·00	16	14	74·6	2	42·5	7
XIV.		Colmonell	3·49	+ ·29	1·02	14	15	78·0	9	41·0	5, 23
XV.		Tighnabruaich	5·08	...	1·42	4	18	70·0	18	43·0	6, 13
,,		Mull (Quinish).....	5·00	+ ·89	1·46	4	22	...	...	...	...
XVI.		Loch Leven Sluices	5·41	+ 2·34	1·62	6	18	...	...	...	...
,,		Dundee (Eastern Necropolis)	4·40	+ 2·04	1·55	16	19	77·0	10	39·2	19
XVII.		Braemar	3·42	+ ·65	·86	26	20	68·5	2	35·0	8, 19
,,		Aberdeen (Cranford)	5·27	+ 2·64	1·40	16	21	80·0	9	37·0	7
,,		Cawdor (Budgate)	3·63	+ ·21	1·15	5	20	...	...	...	...
XVIII		Strathconan [Beauly]	5·17	+ ·51	1·62	6	11	...	...	...	...
,,		Glencarron Lodge.....	6·81	— ·09	1·52	3	22	71·1	25	36·6	14
XIX.		Dunrobin	...	...	...	...	...	...	...	...	...
,,		S. Ronaldshay (Roeberry) ...	...	...	...	...	...	...	...	...	...
XX.	IRELAND.	Darrynane Abbey.....	4·35	+ ·63	·88	14	24	...	...	...	...
,,		Waterford (Brook Lodge) ...	3·63	+ ·25	·57	14	18	75·0	8	43·0	7*d*
,,		Broadford (Hurdlestown) ...	4·59	+ 1·61	·71	14	24	74·0	9	47·0	22
XXI.		Carlow (Browne's Hill)	4·58	+ 1·63	·52	26	19	...	...	...	...
,,		Dublin (Fitz William Square)	4·02	+ 1·44	·52	14	23	79·0	9	44·1	7
XXII.		Ballinasloe	4·58	+ 1·31	·80	14	19	73·0	9	42·0	12
,,		Clifden (Kylemore)	6·57	— ·02	1·38	14	21	...	...	...	...
XXIII		Seaforde.....	4·92	+ 1·73	1·19	14	21	88·0	9	40·0	6
,,		Londonderry (Creggan Res.).	4·88	+ 1·18	1·50	14	23	...	...	...	...
,,		Omagh (Edenfel)	4·36	+ ·81	1·20	14	23	75·0	9	44·0	11*e*

+ Shows that the fall was above the average ; — that it was below it.
a and 27. b and 29. c and 8, 20. *d* and 24, 26. *e* and 19, 23.

SUPPLEMENTARY RAINFALL, JULY, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	3·77	XI.	Llandefaelog-fach.....	...
II.	Dorking, Abinger Hall .	4·45	,,	New Radnor, Ednol.....	3·58
,,	Sheppey, Leysdown	5·22	,,	Rhayader, Nantgwillt...	...
,,	Hailsham	5·58	,,	Lake Vyrnwy	4·56
,,	Crowborough.....	5·06	,,	Ruthin, Plâs Dráw	5·17
,,	Ryde, Beldornie Tower..	1·95	,,	Criccieth, Talarvor	4·36
,,	Bournemouth, Kempsey	3·59	,,	I. of Anglesey, Lligwy..	2·90
,,	Emsworth, Redlands ...	3·15	,,	Douglas, Woodville.....	4·77
,,	Alton, Ashdell	3·71	XII.	Stoneykirk, Ardwell Ho.	3·34
,,	Newbury, Welford Park	2·83	,,	Dalry, Old Garroch	4·52
III.	Oxford, Magdalen Coll..	3·17	,,	Moniaive, Maxwelton Ho.	4·19
,,	Banbury, Bloxham	5·11	,,	Lilliesleaf, Riddell	4·36
,,	Pitsford, Sedgebrook ...	3·10	XIII.	N. Esk Res. [Penicuick]	...
,,	Huntingdon, Brampton.	3·39	XIV.	Dalry, Blair	4·70
,,	Wisbech, Bank House...	4·19	,,	Glasgow, Queen's Park..	3·74
IV.	Southend	4·86	XV.	Inveraray, Newtown ...	4·63
,,	Colchester, Lexden	3·90	,,	Ballachulish, Ardsheal...	7·18
,,	Saffron Waldon, Newport	4·36	,,	Campbeltown, Redknowe	4·33
,,	Rendlesham Hall	5·59	,,	Islay, Eallabus..... ...	3·59
,,	Swaffham	2·67	XVI.	Dollar.....	5·64
V.	Salisbury, Alderbury ...	2·73	,,	Balquhidder, Stronvar...	...
,,	Bishop's Cannings	2·85	,,	Coupar Angus Station...	4·12
,,	Ashburton, Druid House	5·02	,,	Blair Atholl	3·42
,,	Okehampton, Oaklands.	3·02	,,	Montrose, Sunnyside ...	5·46
,,	Hartland Abbey	3·41	XVII.	Alford, Lynturk Manse..	6·59
,,	Lynmouth, Rock House	2·57	,,	Keith H.R.S.....	6·34
,,	Probus, Lamellyn	4·47	XVIII.	Fearn, Lower Pitkerrie..	3·21
,,	Wellington, The Avenue	2·51	,,	S. Uist, Askernish	3·06
,,	North Cadbury Rectory	3·00	,,	Invergarry.....	5·90
VI.	Clifton, Pembroke Road	1·75	,,	Aviemore, Alvie Manse.	...
,,	Ross, The Graig	2·52	,,	Loch Ness, Drumnadrochit	4·28
,,	Shifnal, Hatton Grange	2·09	XIX.	Invershin	2·77
,,	Wem Rectory	2·53	,,	Bettyhill	3·35
,,	Cheadle, The Heath Ho.	3·32	,,	Watten H.R.S.....	3·73
,,	Coventry, Kingswood ...	...	XX.	Cork, Wellesley Terrace	6·42
VII.	Market Overton	2·27	,,	Killarney, District Asyl.	3·91
,,	Grantham, Stainby	1·72	,,	Glenam [Clonmel]	5·89
,,	Horncastle, Bucknall ...	2·35	,,	Ballingarry, Hazelfort...	4·69
,,	Worksop, Hodsock Priory	2·20	,,	Miltown Malbay	4·70
VIII.	Neston, Hinderton	4·99	XXI.	Gorey, Courtown House	4·17
,,	Southport, Hesketh Park	2·51	,,	Moynalty, Westland ...	3·82
,,	Chatburn, Middlewood.	4·48	,,	Athlone, Twyford	4·32
,,	Duddon Val., Seathwaite Vic.	7·54	,,	Mullingar, Belvedere ...	5·53
IX.	Langsett Moor, Up. Midhope	3·29	XXII.	Woodlawn	4·88
,,	Baldersby	3·44	,,	Westport, Murrisk Abbey	5·00
,,	Scalby, Silverdale	3·73	,,	Crossmolina, Enniscoe ..	5·12
,,	Ingleby Greenhow Vic..	4·14	,,	Collooney, Markree Obs.	5·19
,,	Middleton, Mickleton ...	3·51	XXIII.	Enniskillen, Portora ...	4·88
X.	Beltingham	4·99	,,	Warrenpoint.....	7·38
,,	Bamburgh	5·27	,,	Banbridge, Milltown ...	5·95
,,	Keswick, The Bank.....	4·37	,,	Belfast, Springfield	4·91
,,	Melmerby Rectory	4·93	,,	Bushmills, Dundarave..	4·54
XI.	Llanfrechfa Grange	2·98	,,	Stewartstown	4·63
,,	Treherbert, Tyn-y-waun	4·92	,,	Killybegs	6·84
,,	Castle Malgwyn	4·47	,,	Horn Head	4·61

METEOROLOGICAL NOTES ON JULY, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder: L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—The first half was fine, dry and generally warm, the only R of the first 15 days being ·01 in. on 12th, which terminated an absolute drought of 22 days' duration. A TS early on the 18th, with heavy R, commenced an exceedingly wet period with lower temp., which prevailed till the 29th; during this time 5·07 in. fell. The wettest July in 45 years. Mean temp. 63°·2, or 0°·1 below the average.

ABINGER HALL.—The first half dry, then very wet. In about 20 minutes on the morning of the 18th ·50 in. of R fell. Much bush fruit spoiled by R. Low night temp., with frosts.

TENTERDEN.—The first half dry and warm, the last half very wet, with several TSS. Absolute drought for 15 days ended on 4th, and partial drought for 30 days, with ·20 in. of R, ended on 19th.

CROWBOROUGH.—With the exception of ·02 in. on 5th, no R fell till the 15th, the weather being a continuation of the drought which began on June 20th. After the 15th there was very heavy and continuous R, 2·51 in. falling on 23rd. The first half warm, but during the wet period unseasonably cold. Mean temp. 60°·0.

HARTLEY WINTNEY.—Absolute drought for 23 days ended on the 12th, after which the weather was exceedingly unsettled, with heavy R almost daily until the end. TSS on 18th, 19th and 30th. Temp. very low and weather dull and cloudy.

WINSLOW, ADDINGTON.—In the 24 days ended on 14th only ·01 in. of R was registered, but from the 16th to the end wet weather prevailed. Very heavy TS on 19th.

COLCHESTER, LEXDEN.—Absolute drought for 23 days ended on the 13th. Hot till about the 10th; vegetation very much dried up. The last half very wet and cold.

BURY ST. EDMUNDS, WESTLEY.—No R fell from June 19th to July 12th. Very wet from the 23rd to the end. Corn much laid. T on 23rd, 26th, 29th and 30th.

NORWICH, BRUNDALL.—Like last year during this month the ther. only once reached 80°. The R was the greatest recorded in the neighbourhood in July since 1879, and nearly all fell in the second half, the first half being nearly rainless.

WINTERBORNE STEEPLETON.—The early part was dry, but the latter part very wet; it being the wettest July since 1894. TSS on 26th and 29th.

TORQUAY, CARY GREEN.—R 1·27 in. above the average. Duration of sunshine 237 hours, being 1·5 above the average. Mean temp. 61°·3, or 0°·4 below the average. Mean amount of ozone 4·5; max., 9·0 on 6th with N.W. wind, min., 1·0 on 19th with N.N.W. wind.

WELLINGTON.—The month opened fine and warm, but after the 14th hardly a day touched the average max temp., and R was frequent, although the normal was only exceeded by about ·25 in.

NORTH CADBURY RECTORY.—The coolest, cloudiest, windiest and wettest July in at least 8 years. Very dry till 15th, then very rainy and rather cool. The R was largely exceeded in the immediate neighbourhood to E. and N., owing to the way in which TSS always work away from here. The aggregate R for the 7 months was 1·56 in. more than the previous highest in 7 years.

CLIFTON, PEMBROKE ROAD.—Mostly fine, with several very hot days in the first fortnight, but a few slight showers. Unsettled and showery in the third week, with some T, the remainder cool, with R on most days, and fresh westerly winds. Comparatively little sunshine. R 1·33 in. below the average.

WEM, THE RECTORY.—Dull, and at times very cold. Little sunshine. Some hay still lying in fields at the end.

HULL, PEARSON PARK.—Very unsettled, dull and cloudy. T8S on 11th and 29th. Stormy and cold on 6th and 7th. Sunshine recorded 106 hours.

WALES AND THE ISLANDS.

LLANFRECHFA GRANGE.—Very unsettled; an unusual amount of T and L, but not near. Hay harvest interfered with, though some was secured well in the first fortnight.

HAVERFORDWEST.—Very unsettled, with some low night temps. Hot and summerlike from the 8th to the 14th, followed by some very oppressive days; no T8S, but persistent, strong, and often cold winds following R. Hay crops much damaged by wet. Potatoes good, but fruit scarce. Duration of sunshine 188·8 hours.

DOUGLAS, WOODVILLE.—Cold and ungenial with N. to N.W. winds, while only 4 wetter Julys have occurred in 30 years. A violent N.W. gale sprang up on the 5th, lasting some 30 hours.

SCOTLAND.

CARGEN [DUMFRIES].—Dull, cheerless, and full of sudden variations in temp. and other conditions. Hay work much interfered with, and turnip crop likely to be the worst for years.

RIDDELL.—R 1·51 in. above the average. Cold and rainy, with much wind, especially from the E.

BALLACHULISH, ARDSHEAL.—The wettest July ever recorded at this station. R 2·15 in. above the average.

COUPAR ANGUS.—R nearly twice the average, and the total from January 1st 6·71 in. above the average. Mean temp. 57°·1; slightly below the average. No lengthened period of summer weather.

BEITYHILL.—The R fell mostly in the earlier half, the fall on the 5th, 1·72 in., being unusually heavy. A number of fine days, chiefly towards the end.

WATTEN, H.R.S.—Cloudy, cold, and with little sunshine. Frost on several nights about the middle. A notable R storm on 5th.

IRELAND.

DARRYNANE ABBEY.—R nearly 20 per cent. over the average. Much blight showing in potatoes.

BROADFORD, HURDLESTOWN.—Very wet. Hay cut during the month is quite ruined, and blight has appeared on the potatoes.

MILTOWN MALBAY.—Rather cool, with much T, and only a few dry days. Bad for hay making in this district. Blight appearing generally on the potato crop.

DUBLIN, FITZWILLIAM SQUARE.—Though an average month as to temp. it was in other respects unfavourable, the weather being for the most part unsettled, and R both frequent and heavy. Mean temp. 60°·1, or 0°·2 below the average. Duration of sunshine 169·3 hours.

MARKREE OBSERVATORY.—Very wet, with frequent T8S, and temp. very low throughout. A small amount of sunshine, the days generally cloudy and gloomy, but the nights fine and bright. A few fogs.

BELFAST, SPRINGFIELD.—R an inch above the average. T and L very prevalent. Very disappointing for farmers.

OMAGH, EDENFEL.—Up to the 12th the weather was better than the record would indicate. The temp. was about normal, what R there was fell at night, and for those who took advantage of it an abundant hay harvest was well saved. The remainder of the month was of the character too frequently typical of these parts in July, deluging, but not continuous rains, dull skies and mostly stagnant atmosphere, but no damage that a few fine days would not repair.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEBRUARY, 1903.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	59·0	20	48·1	18	50·8	40·0	40·5	85	86·0	19·5	·83	10	6·6
Malta	63·2	24	42·5	4, 19	59·6	47·9	45·6	78	111·6	37·1	1·52	7	6·2
Lagos, W. Africa	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	92·1	11	53·7	18	76·9	60·0	56·4	67	...	...	·22	3	3·2
Durban, Natal	92·9	28	63·6	25	84·7	68·0	...	...	149·1	...	2·40	13	3·2
Mauritius	87·8	11*a*	68·8	22	85·8	73·1	72·4	81	154·4	63·5	6·00	16	6·6
Calcutta	89·1	27	49·8	5	82·0	59·8	56·4	63	144·0	41·9	·64	1	2·4
Bombay	89·2	8	61·7	7	82·7	67·0	62·1	67	137·8	52·9	·00	0	0·1
Madras	91·4	15*b*	67·2	8	87·0	71·9	70·4	78	141·9	63·0	2·17	3	2·8
Kodaikanal	72·9	28	45·6	9, 22	66·2	48·6	45·4	70	136·6	33·2	1·00	3	3·9
Colombo, Ceylon	93·9	23	68·5	1, 3	90·4	73·6	71·6	77	152·0	62·2	3·95	5	4·0
Hongkong	72·8	25	41·9	3	62·7	55·1	50·2	73	127·6	...	·21	3	7·8
Melbourne	104·4	9	42·7	25	76·3	56·8	50·5	61	165·3	36·3	1·36	8	5·3
Adelaide	105·6	9	49·6	15	81·5	58·9	50·9	52	161·9	45·0	1·00	5	4·2
Coolgardie	106·6	19	51·0	15	89·3	60·8	53·0	47	172·0	47·2	·38	3	3·2
Sydney	98·1	3	59·3	12	81·0	65·9	60·5	67	139·5	52·6	1·02	8	5·3
Wellington	78·0	24	43·0	3	68·3	54·4	53·5	77	138·0	32·0	1·88	12	6·5
Auckland	78·0	15	50·0	2	71·8	58·9	53·3	65	142·0	49·0	2·08	9	4·7
Jamaica, Negril Point	89·9	14	66·5	4	85·8	69·5	68·1	73	...	...	1·22	1	...
Trinidad	90·0	19*c*	64·0	13*d*	88·0	67·0	69·5	77	164·0	60·0	·68	6	...
Grenada	86·2	19	70·6	26	83·0	72·8	69·3	73	150·0	...	2·27	13	3·0
Toronto	45·5	28	—5·7	17	32·1	19·4	22·6	79	56·2	—8·8	2·80	16	7·1
Fredericton, N.B.	49·8	28	20·5	19	28·5	8·2	6·5	58	...	...	4·36	9	5·5
Winnipeg	36·0	27	—36·7	15	14·5	—8·6	...	...	...	...	·10	2	2·2
Victoria, B.C.	53·3	22	27·2	12	44·6	35·0	...	...	...	...	1·31	9	6·2
Dawson	21·6	28	—53·1	11	—0·6	—17·8	...	...	...	...	1·35	6	4·3

a—and 19, 24. *b*—and 27. *c*—and 23. *d*—and 25.

MALTA.—Mean temp. of air 52°·7, or 1°·5, below; mean hourly velocity of wind 9·4 miles, or 2·4 below averages. Mean temp. of sea 60°·0.

Mauritius.—Mean temp. of air 0°·3 above, dew point 2°·1 above, and R 1·01 in., below averages. Mean hourly velocity of wind 3·6 below average, extremes 23·5 on 8th, and 0·0 on 2nd, 4th, and 16th; prevailing direction E. by S.

KODAIKANAL.—Mean temp. of air 55°·3. Mean velocity of wind 293 miles per day. Bright sunshine 203·1 hours.

COLOMBO.—Mean temp. of air 80°·9, or 0°·5 above, of dew point 3°·1 above, and R 1·66 in. above, averages. Mean hourly velocity of wind 7·1 miles, prevailing direction N.E. to S.W.

HONGKONG.—Mean temp. of air 58°·4. R 1·10 in. below average. Sunshine 77·2 hours. Mean hourly velocity of wind 12·6 miles; prevailing direction E. by N.

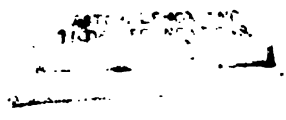
Adelaide.—Mean temp. of air 70°·2, has only once been lower in February during previous 46 years. R ·39 in. above average. Good rains over agricultural settlements.

Sydney.—Mean temp. 2°·4 above, humidity 6·0 below, and R 3·88 inches below averages.

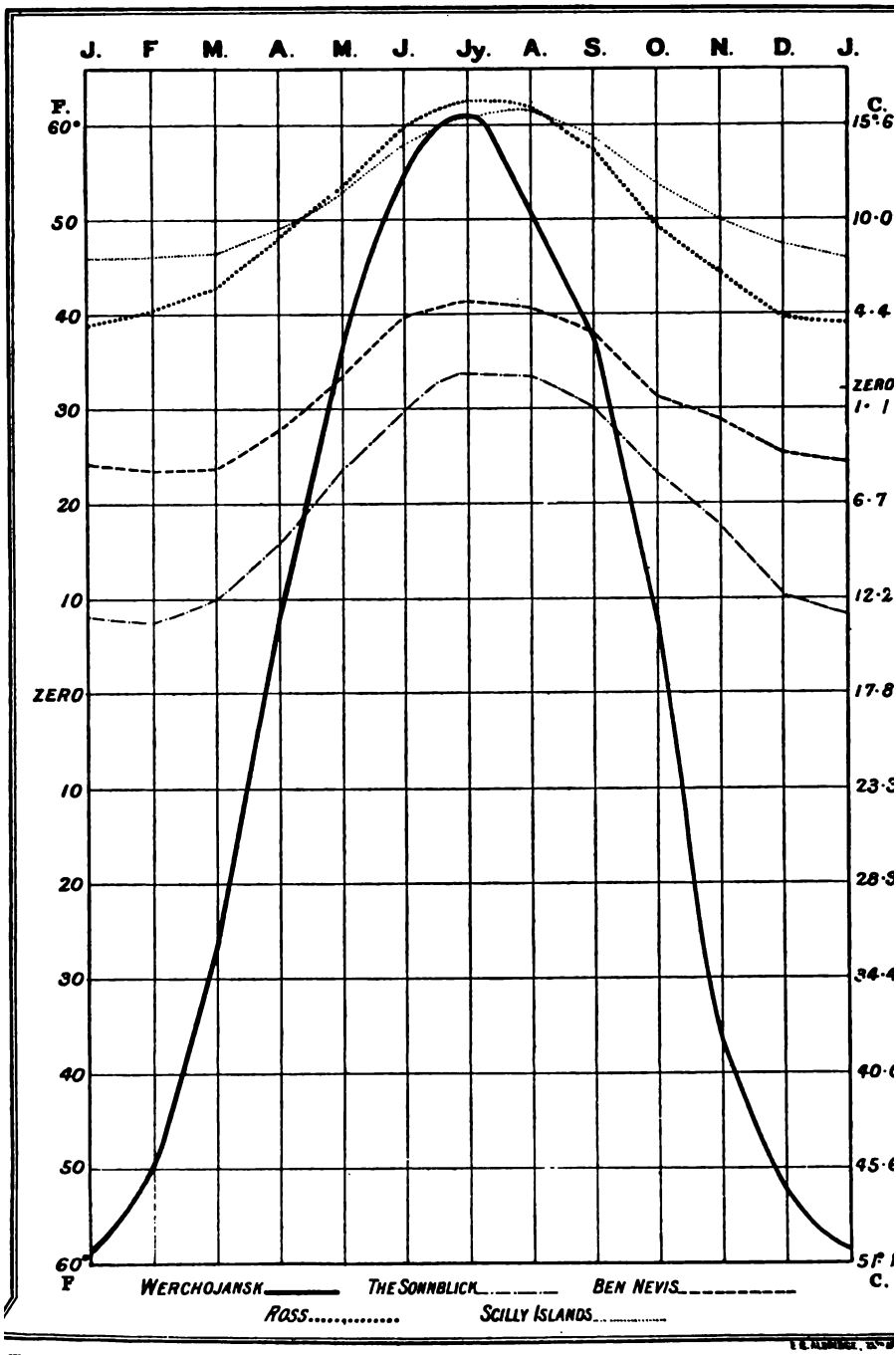
Wellington.—Mean temp. 1°·2 below, and R 1·66 in. below, averages.

Auckland.—Mean temp. 2°, and R 1½ in., below averages.

TRINIDAD.—R ·77 in. below the 40 years' average.



TYPICAL TEMPERATURE CURVES.



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SYMONS'S
METEOROLOGICAL MAGAZINE.

No. CCCCLII.] SEPTEMBER, 1903. VOL. XXXVIII.

THE BRITISH RAINFALL ORGANIZATION.

THE RETIREMENT OF MR. SOWERBY WALLIS.

To the Editor of Symons's Meteorological Magazine.

I HAVE received so many letters expressing regret for my ill health and appreciation of the great work founded by the late G. J. Symons in which we have been associated during the last few years, that it is impossible to answer all in writing.

I shall therefore be glad, if you will allow me in the pages of the *Meteorological Magazine*, to express my most hearty thanks for all the kind references to myself and my grateful acknowledgment of the testimony to the value of the British Rainfall Organization.

H. SOWERBY WALLIS.

6, Hilldrop Road, Camden Road, London, N.
5th September, 1903.

ON August 31st, Mr. Sowerby Wallis retired from the charge of the British Rainfall Organization, after a connexion with the work extending over more than thirty years, and Dr. H. R. Mill, who had during the last three years shared Mr. Wallis's labours, has succeeded to the sole responsibility. The occasion is one which justifies a few lines of retrospect and anticipation.

Early in 1859 George James Symons, then a youth of twenty, began collecting records of rainfall, having realized, thus early, the importance of obtaining very numerous data in order to study the distribution of rain. In the following year he joined the staff of the Meteorological Office, then a department of the Board of Trade, and his interest in the subject did not diminish, though it did not form part of his official work. From the hunt for old records he went on to the collection of actual observations. Towards the end of 1860 Mr. Symons sent out to all observers of whom he knew in England, a circular commencing with an almost prophetic forecast of the work he set before him—

"Observations of rainfall have been made in various parts of the British Isles for upwards of a century, yet no one has, I believe, attempted the somewhat herculean labour of collecting the published and unpublished results . . . . . This investigation I have commenced."

The result was the publication of a four-page quarto pamphlet, entitled "English Rainfall, 1860," in which 168 stations were included. In the few lines of introduction Mr. Symons said that he had "commenced an extensive investigation," though how extensive it was ultimately to prove he could then have had little idea. Next year the publication referred to both 1860 and 1861, and took the style and title it has since retained—"British Rainfall." It included 360 records from England, 11 from Wales, 115 from Scotland, and 21 from Ireland, a total of 507, and the little volume was published on February 15th, 1862.

By 1863 the hobby of his leisure had grown to such dimensions that Symons left the Meteorological Office and deliberately set himself to the collection and discussion of rainfall statistics as his serious life work. As the number of observers grew under the enthusiastic care of the organizer, the expense of collection and publication grew also, and although at first he himself bore it all, later, and by degrees, a greater and greater proportion of the ever growing amount was contributed by observers and friends of meteorological science. Thus in ten years the annual volume of statistics demanded not the leisure which a government clerk could find after office hours in six weeks, but the whole time of an experienced man of uncommonly quick and accurate eye and hand, working for five months without intermission. The work had assumed national proportions, and observations from 1500 stations were being published annually. Although national in scope and purpose, Mr. Symons felt that unless the support of the State could be given without any hampering conditions, he could develop the work best as an organization under private direction, the results of which were presented to the public as fully as the funds supplied by the public permitted.

A serious illness in 1871 brought home to Mr. Symons's mind the necessity of making some provision for the future of the enterprise which he had brought so far. In the annual circular, at the end of 1871, he said :—

"I thankfully acknowledge the assistance whereby I have been enabled to raise the system of rainfall observation to its present unequalled position, but I should very much prefer that its maintenance did not depend on the frail thread of one man's life. To secure this a successor must be trained."

A remarkable gift which Mr. Symons possessed, in a perfection rarely seen, was the power of initiation in a form so complete that subsequent development rarely or never required any alteration. For example the page of *British Rainfall* in 1860 hardly differed in

arrangement from that at the present day. An equally remarkable gift was his power of appreciating character. He set out to train a successor, and Mr. Sowerby Wallis, then a very young man, was his choice.

Mr. Wallis began work as Mr. Symons's assistant at Camden Square in 1872, the wettest year which ever rained over the British Isles so far as our records can tell. He adapted himself so quickly and completely to his duties that he soon became indispensable to Mr. Symons, and so far as his rainfall work was concerned practically inseparable from him. Few indeed could tell, after a few years had elapsed, from which of the two pens an unsigned article came.

By 1890 the number of stations dealt with in the annual volume reached 3,000, and it was impossible to issue it before the beginning of July—a year earlier, by the way, than similar publications are usually issued by Government offices. In the preface to *British Rainfall*, 1890, Mr. Symons says :—

"I am glad to acknowledge how much I owe to Mr. Sowerby Wallis, who has now been helping me for nearly twenty years, working as those only do whose hearts are in their work, until he is as familiar with the details and routine as I am. And that is why in this, my thirtieth annual issue, I have asked him to let me put his name along with mine on the title page."

From that time onward the name of Mr. Sowerby Wallis has appeared on the annual volume, in the preparation of which he took an increasing part. The sudden death of Mr. Symons in March, 1900, threw upon Mr. Wallis an amount of work which would have overwhelmed most men. He grappled with the task, and the punctual appearance of the annual and monthly publications was never interrupted, or even delayed, although at the same time there was a vast amount to be done (and it was all done) in the removal of Mr. Symons's unique library from Camden Square to the Royal Meteorological Society, in winding up all the affairs of a man of the most multifarious interests, and in adapting the Rainfall Organization to its new conditions. The great task was accomplished, but at a price. Mr. Wallis's health suffered severely from successive attacks of influenza, and the rest necessary for complete recovery was never taken. Though for nearly three years the work of the Organization was shared with his successor, Mr. Wallis could never stop working, nor could he work except with all his might. At length repeated warnings decided him that the time had come when he must be free from the responsibilities which he had never shirked during the many years he bore them, and we are sure that all our readers will join us in the confident hope that the leisure thus secured before it is too late, will enable Mr. Wallis to re-establish his health, and that a long and useful life still lies before him.

Dr. H. R. Mill has acquired the historic rainfall house, 62, Camden Square, London, N.W., and the rainfall records and instruments which have been accumulated there. If the lapse of time has made

some changes in detail desirable, these changes will no doubt be made, but in all essentials the Rainfall Organization will continue to move in the straight course which its founder impressed upon it. The three assistants trained by Mr. Symons and Mr. Wallis remain to give the Organization the benefit of their valued experience.

The time seems now to have come when a critical comparison of the rainfall of the British Isles from year to year may be commenced with reasonable certainty of success. For this it is necessary to arrive at some standard for comparison, so that one year may be studied in relation to another more fully and systematically than is possible when working with the short average that must be used in the annual volume. The work would be a heavy one, and if it extended to the preparation of a complete series of monthly as well as of annual rainfall maps, it would be almost too great to attack, still it seems that the study of maps on which all the results for individual years, or shorter periods, are plotted is the most promising field for rainfall research at the present moment. Hence it is more than ever necessary to secure new observers in the desert places of our islands where gauges are most thinly scattered. In scientific work there is no standing still; when research in one direction is systematized into routine, a new field is always opening in which experiment and new forms of observation are required. We hope that our readers will continue to help us in the future as in the past by their suggestions, for even when advice cannot be adopted completely, it is often of immense value in suggesting practicable improvements. We feel strongly that this Magazine could be made more useful than it is, and we know that it can be made much fuller and more interesting if only the number of readers were increased two or threefold. We are not justified in attempting any permanent enlargement until it becomes clear that the Magazine will not be a burden on the resources of the Rainfall Organization; it ought instead to be a source of strength.

In entering on the new arrangement we hope to retain the cordial co-operation of the great volunteer army of observers whose work has in the past produced such fine results, and on our part we will keep before us the steady purpose of helping all observers to the utmost of our ability, and of maintaining the great traditions established by the founders of the Organization; though they have left little room for improvement, there is abundant scope for advance.

BOOKS RECEIVED.

Quarterly Record of the Royal Botanic Society of London. No. 92. Vol. VIII. London. Size 8¼ × 5½. Pp. 16.

The Weather of 1902 at Hodsock Priory, Worksop. By H. Mellish. Size 8½ × 5½. Pp. 5 and one table.

Hull Corporation Waterworks. Sixth Annual Report of the Water and Gas Engineer. By F. G. Bancroft. 1903. Size 9½ × 6. Pp. 12, one plate and one table.

THE RAINFALL OF THE SUMMER OF 1903.

LONDON is the journalistic as well as the political capital of the British Isles, and consequently occurrences in and around London are apt to acquire an importance all over the country out of proportion to their real magnitude. It is so with the rainfall of the summer of 1903, which was so exceptionally severe in the lower Thames Valley as to create a general impression that the condition was widespread. The accompanying Table, giving the rainfall at 51 well-distributed stations for June, July and August, shows that in North Wales, Lancashire, and the extreme west of Ireland, the summer was actually rather drier than the average, and by far the greater part of the British Isles showed a total rainfall for the three months less than 25 per cent. in excess of the average. The centre of Ireland showed an excess of a little over 30 per cent.; the middle of Scotland had an excess of from 40 to 50 per cent., while the Highlands and the Southern Uplands had scarcely more than the average fall. Indeed, were it not for the curious state of matters in the south east of England, the rainfall of the summer of 1903 would hardly call for remark. Eastward from the borders of Cornwall and Wales to the North Sea the excess of rainfall much exceeded 50 per cent., and within a roughly circular area with a radius of about 40 miles from London the excess was greater than 100 per cent., in other words, more than twice the normal amount. June was the wettest and August the least wet of the three months as a rule. The most striking cases, reduced to percentages, are as follows: Camden Square, average fall for three summer months, 6·25 in.; actual fall, 15·87 in., or if the average rainfall is taken as 100, that for last summer was no less than 254, or two-and-a-half times as great; at Hitchin the ratio was 222, at Winslow 194, and at Hartley Wintney 180.

The high rainfall in this particular district was accompanied, as our recent numbers have shown, by an exceptional number of heavy falls on rainfall days, without, however, many violent thunderstorms. Up till 1903, the only year in which so many as five days had a rainfall each exceeding one inch at Camden Square was 1878; but up to September 4th, 1903, there had been seven days with falls exceeding one inch, and more than a quarter of the year has still to run.

The table of aggregate rainfall for the eight months, January to August inclusive, taking account of the wet spring in Scotland and the north of England, shows a fairly uniform excess of rainfall for the year so far as it has gone. The average excess is about 40 per cent., the greatest being 88 per cent. in London, the least 9 per cent. at Clifden, in the west of Ireland, but no other station is nearly so low.

August was everywhere a rainy month, even the two instances in which the total fall was slightly below the average for the month, had an unusually large number of rainy days.

Three Months' Summer Rainfall, June—August, 1903.

STATIONS.	June.	July.	August.	Total of 3 Months, 1903.	Total of 3 Months' Average.	Difference.
	in.	in.	in.	in.	in.	in.
London	6·43	5·20	4·24	15·87	6·25	+9·62
Tenterden	3·56	3·67	3·63	10·86	7·23	+3·63
Hartley Wintney	5·55	3·40	2·98	11·93	6·66	+5·27
Hitchin	6·40	4·16	3·46	14·02	6·32	+7·70
Winslow	5·17	3·47	3·85	12·49	6·45	+6·04
Westley	3·11	3·82	3·78	10·71	7·35	+3·36
Brundall	2·45	5·37	2·72	10·54	7·26	+3·28
Alderbury	3·28	2·73	3·70	9·71	6·50	+3·21
Ashburton	2·70	5·02	5·19	12·91	9·39	+3·52
Polapit Tamar	1·80	3·54	4·55	9·89	8·75	+1·14
Stroud	4·12	3·89	3·83	11·84	7·15	+4·69
Woolstaston	3·16	3·13	5·23	11·52	7·31	+4·21
Boston	1·59	2·53	4·57	8·69	5·75	+2·94
Hesley Hall	1·42	2·23	3·69	7·34	5·85	+1·49
Derby	1·26	2·20	4·86	8·32	6·48	+1·84
Bolton	2·34	3·77	5·67	11·78	12·18	— ·40
Wetherby	2·48	3·24	2·42	8·14	6·65	+1·49
Arncliffe	2·34	5·04	8·63	16·01	14·25	+1·76
Hull	1·74	2·68	3·19	7·61	6·91	+ ·70
Newcastle	3·06	4·73	2·24	10·03	7·48	+2·55
Seathwaite	3·96	10·25	21·14	35·35	27·91	+7·44
Cardiff	2·09	4·58	6·00	12·67	9·74	+2·93
Haverfordwest	2·13	3·75	5·66	11·54	9·33	+2·21
Gogerddan	2·26	5·09	6·61	13·96	10·21	+3·75
Llandudno	1·11	2·56	3·51	7·18	7·35	— ·17
Dumfries	1·84	5·01	5·02	11·87	10·20	+1·67
Lilliesleaf	1·48	4·36	3·53	9·37	8·16	+1·21
Colmonell	1·99	3·49	4·72	10·20	9·86	+ ·34
Glasgow	1·74	3·74	6·28	11·76	9·19	+2·57
Inveraray	2·96	4·63	10·95	18·54	15·28	+3·26
Islay	·94	3·59	7·13	11·66	10·11	+1·55
Mull	2·34	5·00	8·08	15·42	12·66	+2·76
Loch Leven	2·87	5·41	4·78	13·06	9·11	+3·95
Dundee	2·20	4·40	5·30	11·90	7·00	+4·90
Braemar	1·42	3·42	4·31	9·15	8·77	+ ·38
Aberdeen	1·59	5·27	4·29	11·15	8·07	+3·08
Cawdor	2·38	3·63	3·03	9·04	8·89	+ ·15
Glencarron	3·90	6·81	12·31	23·02	21·18	+1·84
Dunrobin	1·36	5·23	3·94	10·53	7·29	+3·24
Darrynane	4·12	4·35	5·88	14·35	11·31	+3·04
Waterford	5·31	3·63	4·62	13·56	9·92	+3·64
Broadford	1·33	4·59	5·21	11·13	8·97	+2·16
Carlow	3·15	4·58	5·06	12·79	8·65	+4·14
Dublin	2·49	4·02	2·80	9·31	7·46	+1·85
Mullingar	1·20	5·53	6·68	13·41	10·37	+3·04
Ballinasloe	2·04	4·58	6·69	13·31	9·85	+3·46
Clifden	2·32	6·57	10·11	19·00	19·92	— ·92
Crossmolina	·94	5·12	7·68	13·74	11·57	+2·17
Seaforde	2·97	4·92	4·26	12·15	9·05	+3·10
Londonderry	·87	4·88	6·93	12·68	11·26	+1·42
Omagh	1·95	4·36	7·92	14·23	10·80	+3·43

THE INTERNATIONAL METEOROLOGICAL COMMITTEE.

THE members of the International Meteorological Committee, which held its meeting at Southport simultaneously with the British Association, gathered in London on September 7th, and on that evening they were entertained to dinner in the Trocadero Restaurant by Dr. W. N. Shaw, F.R.S., who invited a number of meteorologists and representatives of allied sciences to meet the foreign guests. The following were present:—

Mr. F. Campbell Bayard, Sec. R. Met. Soc.
Dr. von Bebber, Hamburg.
M. Teisserenc de Bort, Paris.
Mr. C. V. Boys, F.R.S.
Dr. C. Chree, F.R.S., Kew.
Mr. F. W. Dyson, Greenwich.
Dr. R. T. Glazebrook, F.R.S.
Prof. G. Hellmann, Berlin.
Captain Campbell Hepworth, C.B.
Prof. H. Hergesell, Strasburg.
Prof. H. Hildebrandsson, Upsala.
Prof. J. Larmor, Sec. R.S.
Mr. R. G. K. Lempfert.
Sir Norman Lockyer, K.C.B., F.R.S.
Dr. W. J. S. Lockyer.
M. Mascart, Paris.
Mr. E. Mawley.
Dr. H. R. Mill.
Prof. H. Mohn, Christiania.
Prof. Willis Moore, Washington.
Prof. A. F. W. Paulsen, Copenhagen.
Prof. J. M. Pernter, Vienna.
Mr. A. Laurence Rotch, Blue Hill Observatory.
Prof. Rykatcheff, St. Petersburg.
Prof. A. Schuster, F.R.S, Manchester.
Dr. R. H. Scott, F.R.S.
Dr. W. N. SHAW, F.R.S., the host.
Prof. M. Snellen, Utrecht.
Captain Tizard, R.N., F.R.S.
Prof. H. H. Turner, F.R.S., Oxford.
Dr. Theodore Williams.
Mr. C. T. R. Wilson, Cambridge.

In welcoming the guests after dinner, Dr. W. N. Shaw said that in any other country any such international committee as that about to meet at Southport would be formally welcomed by a Grand Duke or at least a Minister of State; but here science was not held in such esteem in government circles, and scientific men were left to greet their scientific colleagues. On behalf of the leading scientific institutions of this country he could bid the members of the Committee welcome, and he expressed regret that some of the number were unable to be present, naming especially Professor Palazzo, of Rome, and Dr. Billwiller, of Berne. The Chairman then proposed the toast of the Foreign Members of the International Committee, coupled with the names of M. Mascart and Professor Willis Moore, who replied. Professor Pernter proposed the toast of the old masters of Meteorology, former members of the Committee; and to this Dr. R. H. Scott responded, remarking that only Hann, von Neumeyer, Buchan and himself now survived of those who met at Leipzig in 1872. Sir Norman Lockyer and Dr. Larmor welcomed the visitors on the part of the British Association and the Royal Society respectively. Professor Willis Moore, in replying, spoke of the admirable work done by the Meteorological Office on an utterly inadequate grant of public money, observing that as much was spent on the local weather services of Boston and New York alone as on the whole British system.

There was opportunity for much general conversation, and an excellent foundation was laid for the serious work of the Committee at Southport.

Correspondence.

THE STUDY OF SUNSPOT CYCLES.

To the Editor of Symons's Meteorological Magazine.

MUCH attention is now being given to meteorological correlations with the sun-spot cycle of eleven years' mean.

To ensure absolute comparisons it is plainly important that all who are working in this field should give the same value to the same years. Since the actual cycles vary so greatly (14 years to 10 years from min. to min.; 3 to 6 from min. to max.; 11 to 3 years from max. to min.), it is absolutely necessary to "doctor" the years to compare cycle with cycle on the basis of mean values (11 years min. to min.; 5 years min. to max.; 6 years max. to min.)

Is not the most logical way to treat the years of each cycle as if printed on an elastic ribbon, fixed at years 1 and 12 for minima and 6 for the maximum? If, then, the intervening years are more or less than the normal 4 between min. and max. and 5 between max. and min., the years will be puckered or stretched out respectively over the intervening space.

The appended table represents one that I have been using, so far as the last century is concerned.* The letters C, D, E, &c., and Roman numerals I., II., III., &c., afford means of easy reference. It will be noted as a necessary, but important, consequence of the system that the years next each critical date remain undoctored.

Could some such scale be generally accepted it would surely be an important gain.

Year Plan for Reduction of Years to Mean Sunspot Cycle Curve.

Cycle.		Min. I.	II.	III.	IV.	V.	Max. VI.	VII.	VIII.	IX.	X.	XI.	Min. I.
1798·3—1810·6	C	98	9	0	1-2	3	04	5	6	7	8	9	10
1810·6— 23·3	D	10	1	2-3	3-4	5	16	7	8	9-10	1	2	23
23·3— 33·9	E	23	4	5-6	7-8	9	30	1	1	1-2	2	2	33
33·9— 43·5	F	33	4	4-5	5-6	6	37	8	9	0	1	2	43
43·5— 56·0	G	43	4	4-5	5-6	6	47	8	9-0	1	2-3	4	55
56·0— 67·2	H	55	6	6-7	7-8	8	59	0	1-2	3	4-5	6	67
67·2— 78·9	K	67	8	8-9	8-9	9	70	1	2-3	4	5-6	7	78
78·9— 89·6	L	78	9	0	1	2	83	4	5	5-6	6-7	8	89
89·6—(?)01·5	M	89	0	1	1-2	2	93	4	5-6	7	8-9	0	01
	N	01	2										

J. EDMUND CLARK.

Lile Garth, Ashburton Road, Croydon, Sept. 3rd, 1903.

[We should be glad to hear the opinion of our readers on the foregoing suggestion.—ED. *S.M.M.*]

* As the investigation was confined to the three months August to September, a careful comparison with Wolf's and Wolfer's unreduced sunspot values caused the adoption of 1799 and 1888 as years for minima.

HEAVY RAINFALL ON JULY 23RD.

To the Editor of Symons's Meteorological Magazine.

A SHOWER of rain fell about midday on Thursday, the 23rd July, to the extent of ·20 of an inch. After that rain fell as shown below, the readings being cumulative :—

Hour.	Gauge reading. in.	Amount. in.	
		·20	
6.40 p.m.	Zero	—	
7.5	·23	·23 in	25 min.
7.15	·58	·35 ,,	10 ,,
7.23	·83	·25 ,,	8 ,,
7.35	1·03	·20 ,,	12 ,,
7.50	1·34	·31 ,,	15 ,,
8.5	1·80	·46 ,,	15 ,,
8.50	1·97	·17 ,,	45 ,,
10.0	2·55	·58 ,,	70 ,,
11.30	3·02	·47 ,,	90 ,,
12.30 (midnight)	3·29	·27 ,,	60 ,,
12.45 a.m.	3·37	·08 ,,	15 ,,
5	3·89	·52	
7	4·01	·12	
8	4·05	·04	

The total rainfall in the 24 hours being **4·25** ins.

W. B. BRYAN.

Lea Bridge, Clapton, N.E., 24th August, 1903.

THE WET SUMMER.

To the Editor of Symons's Meteorological Magazine.

THE local rainfall for the past month of August, measured this day at 9 a.m., amounts to **4·42** ins. It was 3·32 in. for August, 1902, 1·65 in. for August, 1901, and 3·36 in. for August, 1900. The total rainfall for the three months, June, July and August, amounts to 18·14 in., and for eight months, January to August, 26·31 in., all recorded under the same conditions.

Comparisons.

Periods.	1903. in.	1902. in.	1901. in.	1900. in.
January to May	8·17	6·38	6·40	7·88
June to August	18·14	7·38	5·47	7·87
Eight months	26·31	13·76	11·87	15·75
September to December		4·70	7·31	6·26
Twelve months		18·46	19·18	22·01

A. J. WILMSHURST.

6, Albany Road, Manor Park, E., 1st Sept., 1903.

EXCESSIVE RAINFALL IN SHORT PERIODS.

To the Editor of Symons's Meteorological Magazine.

IN your Magazine for August you draw attention to the necessity of measuring quickly after a heavy fall of rain has occurred, with the view of discovering whether the amount be exceptional or no.

Bearing this in mind, after a recent series of heavy downpours, I measured directly after the cessation of each fall, with the following results:—On the 24th of August heavy rain commenced at 3 p.m., and continued till 5 p.m., during which period 0·81 in. fell, but between 8.25 and 8.35 the same evening a veritable torrent deposited 0.57 in. in the gauge in the 10 minutes, causing much flooding in this neighbourhood.

I may add that the rainfall for the three summer months, June, July and August, has amounted at this station to 16·90 inches, with *five* occasions in the period on which an inch or more was precipitated in less than 24 hours.

D. W. HORNER.

Clapham Park, S. W., Sept. 2nd, 1903.

P.S.—Since the above was written, yet another fall of over one inch has occurred in a space of less than 24 hours, viz., 1·24 in., measured at 9 a.m. September 5th.—D.W.H.

To the Editor of Symons's Meteorological Magazine.

REFERRING to the records of rainfall on or about the 23rd and 24th ult., in your number for August, I venture to send you the enclosed from my sister, Mrs. Eliot Howard, of Ardmore, Buckhurst Hill, Essex (on the border of Epping Forest), as the figures she mentions appear to exceed any of those named by your correspondents. She is a careful observer, and has worked with a gauge for many years.

F. F. TUCKETT.

Frenchay, near Bristol, August 18th, 1903.

"I wonder whether your rain record is like ours. We had **4·35** between 6.30 p.m. on Thursday, July 23rd, and 7 and 8 on Friday, 24th, morning—say 13 hours; then again last night (Saturday, 25th July) ·95 in."

AUGUST RAINFALL—AN EXCEPTIONAL CASE.

To the Editor of Symons's Meteorological Magazine.

A PARAGRAPH in *The Times* states "The rainfall during August was nearly double that in the same month last year."

This was doubtless the case in many places, but not here, where the total fall was 3·49 in. against 4·29 in. last year, or less by ·80 in. I may add that there was no thunderstorm this year, and only one last year, which gauged ·69 in.

CHARLES S. PRINGLE.

Whitekirk, Southbourne, Hants.

AUGUST RAINFALL IN IRELAND.

To the Editor of Symons's Meteorological Magazine.

YOU may like to compare the rainfall at Cloondrah, Longford, for other wet months with that for August, 1903, which was the heaviest since the commencement of records in May, 1892.

1892, August.....	5·78 in.	1896, July	5·82 in.
1895, July	5·01 ,,	1903, July	5·08 ,,
,, August.....	5·05 ,,	,, August.....	6·32 ,,

These are the only instances during 11 years in which the monthly fall was 5 inches or over.

F. DUDLEY FLETCHER.

Shannon Navigation Office, Limerick, 1st Sept., 1903.

CURVES OF MONTHLY MEAN TEMPERATURES FOR VERKHOYANSK (SIBERIA), THE SONNBLICK (AUSTRIAN ALPS), BEN NEVIS, ROSS, AND THE SCILLY ISLES.

By EDWARD G. ALDRIDGE, F.R.Met.Soc., F.G.S.

VERKHOYANSK.

THE Verkhoyansk* curve has been laid down from the means of 13 to 15 years, the observations there being often interrupted. The values have been supplied by Professor Woeikof. They were calculated in 1897; are derived from observations taken daily at 7 a.m., 1 p.m., and 9 p.m.; and have been reduced to the level of the sea by adding 1°·3 for a somewhat doubtful altitude of 470 ft. (Dr. Hann's ratio). It will be understood that the *actual* values are 1°·3 less than those given by the curve. The mean annual temperature, reduced to the sea-level, is 2°·7 (—16°·3 C.). It may be noticed that the mean temperature of April exceeds that of October, while June is considerably warmer than August. Probably the explanation of these very un-English results is to be found in the fact that in April and June the length of the day is greater than in October and August respectively. At Verkhoyansk there is little or no marine influence. The temperature has several times reached 96°, but not in the period stated. Frost in July is slight. The "jumps" of the monthly mean temperatures are truly marvellous, and, if I may coin a word, "kangaruvine." The fall (43°·6) of mean temperature between October and November is nearly twice and thrice that from the warmest month to January at Ross and in the Scilly

* The Russian alphabet is transliterated phonetically in different languages, thus in German *w* has the sound of the English *v*, *ch* has the sound of the Scottish *ch* in loch, the nearest English equivalent of which is *kh*, and *j* has the sound of *y*; hence, a German copies the sound of the Russian name by Werchojansk, while an Englishman gives exactly the same sound by Verkhoyansk. Neither spelling is wrong, although one is given on the diagram, another in the text.—ED. *S.M.M.*

Islands respectively. If the mean annual range (119½°) of monthly mean temperature at Verkhoyansk be represented by 100, that of the Scilly Isles is only about 13. The lat. and long. of Verkhoyansk are 67° 34′ N. and 133° 51′ E.

The Sonnblick.

The curve for the Sonnblick (Sun-glimpse) has been prepared from the means of the period from October, 1886, to December, 1900. The values are contained in a printed report entitled *Neunter Jahresbericht des Sonnblick-Vereines für das Jahr 1900*, and this has been sent to me from Vienna. The means are obtained from observations taken daily at 7 a.m., 2 p.m. and 9 p.m., the last reading being used twice. They have not been reduced to the sea-level. The mean annual temperature at an elevation of 3,112 metres (10,210 ft.) is 20°·3 (—6°·5 C.). The Sonnblick is believed to have the highest regular observatory in Europe. It may be seen that, notwithstanding the great altitude of the mountain, the continentality of its climate in respect of mean temperature, as compared with that of Ben Nevis, is well maintained. Absolute extremes = 55°·4 in July, 1894, and —30°·3 in March, 1890.

Ben Nevis.

The Ben Nevis curve has been drawn from the means of the period from 1884 to 1901. They have been sent to me by Mr. R. T. Omond, Honorary Secretary of the Scottish Meteorological Society, and are derived from twenty-four hourly observations daily. They have not been reduced to the level of the sea. The mean annual temperature at an altitude of 1,343 metres (4,406 ft.) is 31°·5 (−0°·3 C.). The absolute minimum temperature (0°·7 on the 6th January, 1894) is 1°·7 higher than that experienced at Mobile, Alabama, in February, 1899, when enormous damage was done to the orange-groves of Florida. This mininum of —1° is 13° below the previous lowest. It is safe to say, I think, that this temperature is the minimum during the Ben Nevis period of 18 years. Mobile is in N. lat. 30° 41′; the elevation of the thermometers may be about 100 ft. A report from Jacksonville, Florida, mentions that the minimum over the western district of the State was as low as —4°. The absolute maximum on the Inverness-shire mountain is 66°·2 on the 24th June, 1887. The mean of May is about the same as that of August on the Sonnblick; the mean of September corresponds fairly well with that of January at Ross. The annual mean is perhaps equivalent to that of the autumnal equinox at Verkhoyansk.

Ross.

The Ross (Herefordshire) curve has been sketched in from the means of the period from 1875 to 1901. They are obtained by dividing by 2 the sum of the mean daily maximum and the mean daily minimum temperature. They have been reduced to the sea-level by

adding 0°·7 for a height of 217 ft. (Herschel's ratio). The mean annual temperature at the sea-level is practically 50° (10° C.). Ross, in N. lat. 51° 55′ and in W. long. 2° 35′, has been selected to represent a thoroughly rural and agricultural district of England. The values have been supplied by Mr. H. Southall of that town. Absolute extremes = 95°·0 on the 16th July, 1876, and 2°·9 on the 21st January, 1881. At Greenwich the mean temperature of October considerably surpasses, I believe, that of the year: at Ross October is 0°·7 colder than the year. The Greenwich warmth at this season may be due to the influence of a tidal river.

The Scilly Isles.

The curve for these islands has been obtained from the means of the period from 1871 to 1900. These have been worked out from values given in the publications of the Meteorological Office, and are derived in the same manner as those of Ross. They have been reduced to the sea-level by adding $\frac{1}{4}$° for 75 ft. (Herschel's ratio). The mean annual temperature at the sea-level is 52°·5 (11°·4 C.). The islands have been chosen as affording the warmest climate, and one of the most equable, in the United Kingdom. Absolute extremes = 75° in July, 1886, June and August, 1893, and August, 1899; and 25° in January, 1894. The temperature during the period has never fallen below 30° in March and December. November is 1° warmer than April, October 1° warmer than May, and September about 1° warmer than June. The mean of May is about the same as that of the whole year. March is but little warmer than January. In December the mean daily minimum is nearly equivalent to the mean daily maximum at Ross.

Temperature Table.

Months	Verkhoyansk.			Sonnblick.	Ben Nevis.	Ross.			Scilly Isles.		
	Absolute Max.	Absolute Min.	Mean (unreduced).	Mean.	Mean.	Mean Daily Max.	Mean Daily Min.	Mean.	Mean Daily Max.	Mean Daily Min.	Mean.
	°	°	°	°	°	°	°	°	°	°	°
Jan....	—8·9	—90·0	—59·8	8·1	24·1	43·3	33·0	38·2	48·8	42·5	45·7
Feb....	14·2	—93·6	—51·0	7·5	23·7	45·7	33·8	39·8	49·0	42·5	45·8
Mar...	37·6	—77·4	—27·6	10·0	23·9	49·7	34·5	42·1	49·7	42·3	46·0
April.	48·0	—46·5	7·5	16·0	27·8	56·1	38·5	47·3	52·6	45·0	48·8
May...	68·0	—29·6	35·2	23·9	33·3	62·6	43·1	52·8	56·6	48·4	52·5
June..	88·7	18·9	53·6	29·8	39·8	69·0	49·4	59·2	61·8	53·4	57·6
July ..	92·7	29·7	59·7	33·6	41·3	71·4	52·6	62·0	64·9	56·5	60·7
Aug...	86·2	19·8	49·3	33·4	40·7	70·4	52·1	61·2	65·3	57·1	61·2
Sept...	69·1	4·1	36·0	30·0	38·0	65·3	48·1	56·7	62·4	54·9	58·6
Oct....	48·4	—38·6	5·9	23·0	31·3	55·7	41·6	48·6	56·9	50·1	53·5
Nov...	20·5	—72·4	—37·7	17·8	28·9	49·2	38·1	43·7	53·0	46·6	49·8
Dec....	—3·5	—82·8	—53·7	10·4	25·2	44·4	33·9	39·2	50·3	43·8	47·0

For Curves see diagram facing p. 129

REVIEWS.

Regenkarte der Provinzen . . . . (Sachsen, Schleswig-Holstein und Hannover, Hessen Nassau und Rheinland, Westfalen u.s.w.) mit erläuterndem Text und Tabellen. In amtlichen Auftrage bearbeitet von PROFESSOR DR. G. HELLMANN. [Four numbers]. Berlin, Dietrich Reimer (Ernst Vohsen), 1902 and 1903. Size $10\frac{1}{2} \times 6\frac{1}{2}$. Pp. 32, 44, 56, 30. *Maps.*

WE have to notice together four new parts of Professor Hellmann's series of rainfall maps of the provinces of Prussia, referring respectively to Saxony and the Thuringian States, Schleswig-Holstein and Hanover, Hesse-Nassau and the Rhineland and to Westphalia with some small neighbouring principalities. Each map represents the mean rainfall for ten years, but not for exactly the same ten years in each case. Between 1890 and 1892 the number of rain observing stations in Prussia was greatly extended, and more than ten years' records from a large number of stations being now available the results are set forth in a form likely to prove practically useful to the residents in each province.

We have only space to touch on one of the many points of interest in these admirable little memoirs and we select the maximum falls in a rainfall day (for Prussia the 24 hours ending at 7 a.m.). There were 22 instances noted (in the four memoirs under review) of falls exceeding 4 in. (101 mm.) in a day, particulars for those over 4·50 in. being :—

Harzburg, *Brunswick*	3rd Aug., 1896	156 mm.	or 6·25 in.
Schlanstedt, *Saxony*	16th May, 1889	153 ,,	,, 6·00 ,,
Schmücke, *Saxe-Coburg Gotha*	24th Nov., 1890	137 ,,	,, 5·40 ,,
Oberhof, ,, ,, ,, ... ,,	,,	127 ,,	,, 5·00 ,,
Lautenthal, *Harz Mts.*	11th July, 1898	122 ,,	,, 4·85 ,,
Mücheln, *Saxony*	7th June, 1896	120 ,,	,, 4·75 ,,
Scharfenstein, *Harz Mts.*	11th July, 1898	119 ,,	,, 4·70 ,,
Ahlden	25th July, 1901	117 ,,	,, 4·60 ,,
Zweifallshammer, *Rhine Prov.*	11th June, 1898	115 ,,	,, 4·50 ,,

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Is it going to rain? Popular weather prognostics, selected and reliable, with notes by EDWARD VERNON, M.A. Edinburgh : Macniven and Wallace. 1903. Size $6\frac{1}{2} \times 4\frac{1}{2}$. Pp. 106. Price 1s. net.

A DAINTILY got up little book in paper covers, bearing the design of a sceptical old gentleman looking at a barometer. The prognostics of rain dealt with are few, but carefully selected, and the explanations of them have a tendency to be rather more "cock-sure" than a meteorologist could altogether approve. It is not easy to find anything new to say of weather prognostics, but the author has managed to clothe his remarks with grace and a touch of humour. This is just the sort of book to send to an intelligent young friend in the country ; it will bore no one and may stimulate the cultivation of observant habits.

Ergebnisse der Arbeiten am Aëronautischen Observatorium (Results of the work at the Aeronautical Observatory) in den Jahren 1900 *und* 1901 *von* RICHARD ASSMANN *und* ARTHUR BERSON. Berlin: A. Asher & Co., 1892. Size 13 × 10. Pp. 280. Price 15 m.

Bericht über die Erforschung der freien Atmosphäre mit Hilfe von Drachen. (Report on the exploration of the free atmosphere by means of kites.) Von Prof. Dr. W. KÖPPEN, *Aus dem Archiv der Deutschen Seewarte.* Hamburg: 1902. Size 11½ × 9. Pp. 104. Plates.

DR. KÖPPEN gives a brief history of the kite as an aid to meteorological research, and describes in much detail the theory and practice of kite-flying as specially employed by the German Marine Observatory at Hamburg.

Messrs. Assman and Berson produce an even more exhaustive report also touching on the history and theory of kite-flying; but mainly concerned with a most interesting account of the Aeronautical Observatory of the Royal Prussian Meteorological Institute in Berlin. It describes the Observatory, its equipment of kites, kite-balloons, and unmanned balloons, and gives an account of the researches carried on by means of these appliances during the first year of work.

THE EIGHT MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—August, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	12·31	188	Arncliffe ...+	15·08	140	Braemar ...+	10·24	149
Tenterden	+5·00	131	Hull	+2·59	117	Aberdeen	+6·16	132
Hartley Wintney	+9·45	162	Newcastle.....	+2·78	117	Cawdor	+4·86	126
Hitchin .....+	11·57	182	Seathwaite +	30·49	139	Glencarron +	17·73	132
Winslow	+9·62	167	Cardiff	+8·64	137	Dunrobin	+5·70	131
Westley.....	+3.93	125	Haverfordwest	+8·72	135	Darrynane ...	+5·52	119
Brundall.....	+3·01	120	Gogerddan ...	+8·62	134	Waterford ...	+7·85	133
Alderbury	+8·08	150	Llandudno ...	+4·96	129	Broadford.....	+8·55	141
Ashburton	+9·38	133	Dumfries ...+	12·84	149	Carlow .....+	10·46	150
Polapit Tamar ...	+7·03	133	Lilliesleaf	+8·57	146	Dublin	+4·62	127
Stroud .....+	10·29	162	Colmonell	+4·67	118	Mullingar...+	10·52	145
Woolstaston	+9·71	155	Glasgow ...+	16·98	177	Ballinasloe ...	+9·40	141
Boston	+5·78	146	Inveraray ...+	15·19	136	Clifden	+4·48	109
Hesley Hall	+3·36	126	Islay	+8·02	130	Crossmolina +	10·21	133
Derby.....	+5·60	139	Mull .....+	10·08	130	Seaforde	+7·84	135
Bolton	+6·16	114	Loch Leven +	14·65	166	Londonderry..	+5·15	120
Wetherby	+7·07	148	Dundee	+6·76	140	Omagh .....+	12·02	149

RAINFALL AND TEMPERATURE, AUGUST, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·24	+ 2·14	1·17	24	18	80·6	8	45·4	11	0	
II.		Tenterden ...	3·63	+ 1·19	·90	14	15	75·7	8	42·0	23	0	
,,		Hartley Wintney ...	2·98	+ ·63	·76	11	21	75·0	8	40·0	23*b*	0	
III.		Hitchin ...	3·46	+ 1·33	·94	11	19	74·0	8	43·0	21	0	
,,		Winslow (Addington) ...	3·85	+ 1·72	·70	24	19	76·0	8	39·0	22	0	
IV.		Bury St. Edmunds (Westley)	3·78	+ 1·38	·92	11	14	72·0	13*a*	44·0	18*c*	0	
,,		Norwich (Brundall) ...	2·72	+ ·35	·65	11	17	74·0	13	44·4	22	0	
V.		Winterborne Steepleton ...	5·51	...	1·03	11	16	70·0	8	38·0	22	0	
,,		Torquay ...	3·41	...	·82	13	14	70·1	8	47·5	22	0	
,,		Polapit Tamar [Launceston]..	4·55	+ 1·21	1·06	23	20	69·8	8	38·0	22	0	
VI.		Stroud (Upfield) ...	3·83	+ 1·29	·69	23	21	76·0	8	46·0	25	0	
,,		Church Stretton (Woolstaston)	5·23	+ 2·39	·90	24	23	71·5	8	45·5	22	0	
,,		Worcester (Diglis Lock) ...	3·49	+ 1·34	·51	23	20	...	...	...	...	...	
VII.		Boston ...	4·57	+ 2·62	1·54	18	15	72·0	4	44·0	22	0	
,,		Hesley Hall [Tickhill]...	3·69	+ 1·48	1·07	18	12	75·0	8	40·0	23	0	
,,		Derby (Midland Railway)...	4·86	+ 2·74	1·20	24	15	75·0	1	40·0	21	0	
VIII.		Bolton (The Park)...	5·67	+ 1·19	·75	2	24	69·1	8	43·6	22	0	
IX.		Wetherby (Ribston Hall) ...	2·42	+ ·15	·65	17	20	...	...	...	...	...	
,,		Arncliffe Vicarage...	8·63	+ 3·14	1·12	15	24	...	...	...	...	...	
,,		Hull (Pearson Park).	3·19	+ ·57	·82	24	15	73·0	8	46·0	17*d*	0	
X.		Newcastle (Town Moor) ...	2·24	— ·67	·38	30	25	...	...	...	...	...	
,,		Borrowdale (Seathwaite)...	21·14	+ 9·74	3·95	27	28	67·8	25	41·4	12	0	
XI.	WALES.	Cardiff (Ely)...	6·00	+ 1·83	·68	23	21	...	...	...	...	...	
,,		Haverfordwest	5·66	+ 2·00	·62	17	21	68·6	8	43·0	12	0	
,,		Aberystwith (Gogerddan) ...	6·61	+ 2·66	·91	19	18	76·0	8	35·0	11	0	
,,		Llandudno...	3·51	+ ·71	·71	17	20	71·0	8	48·0	12	0	
XII.	SCOTLAND.	Cargen [Dumfries]	5·02	+ ·88	·83	26	18	70·0	1	39·0	22	0	
XIII.		Edinburgh (Royal Observatory)	2·56	...	·73	1	22	64·8	27	44·4	30	0	
XIV.		Colmonell	4·72	+ ·73	·66	14	25	71·0	18	37·0	21	0	
XV.		Tighnabruaich ...	9·45	...	1·15	14	24	63·0	2	42·0	21	0	
,,		Mull (Quinish)...	8·08	+ 2·96	1·23	26	28	...	...	...	...	...	
XVI.		Loch Leven Sluices ...	4·78	+ 1·12	·95	31	18	...	...	...	...	...	
,,		Dundee (Eastern Necropolis)	5·30	+ 2·49	·95	30	20	70·6	12	39·6	25*e*	0	
XVII.		Braemar	4·31	+ ·64	·60	14	27	63·2	2	35·4	30	0	
,,		Aberdeen (Cranford)	4·29	+ ·99	·66	14	26	70·0	27	36·0	22	0	
,,		Cawdor (Budgate) ...	3·03	— ·12	·44	30	24	...	...	...	...	...	
XVIII.		Strathconan [Beauly] ...	6·76	+ 2·36	·85	15	15	...	...	...	...	...	
,,		Glencarron Lodge...	12·31	+ 3·77	1·22	26	29	66·0	8	41·3	13	0	
XIX.		Dunrobin ...	3·94	+ 1·39	·88	30	16	65·0	9	40·0	30	0	
,,		S. Ronaldshay (Roeberry) ...	...	...	...	...	...	...	...	...	...	...	
XX.	IRELAND.	Darrynane Abbey...	5·88	+ 1·39	1·05	13	28	...	...	...	...	...	
,,		Waterford (Brook Lodge) ...	4·62	+ ·69	·90	16	22	69·0	4	39·0	22	0	
,,		Broadford (Hurdlestown) ...	5·21	+ 1·63	·81	26	27	66·0	8, 30	43·0	23	0	
XXI.		Carlow (Browne's Hill) ...	5·06	+ 1·63	·74	23	25	...	...	..	...	...	
,,		Dublin (FitzWilliam Square)	2·80	— ·16	·47	13	26	70·9	30	46·1	21	0	
XXII.		Ballinasloe	6·69	+ 2·76	·89	2	31	66·0	8, 30	40·0	7, 22	0	
,,		Clifden (Kylemore)	10·11	+ 2·21	1·70	14	23	...	...	...	...	...	
XXIII.		Seaforde...	4·26	+ ·96	·46	14	27	74·0	5, 11	39·0	11	0	
,,		Londonderry (Creggan Res.).	6·93	+ 2·51	·86	9	29	...	...	...	...	...	
,,		Omagh (Edenfel) ...	7·92	+ 3·68	·95	30	28	66·0	8	38·0	21	0	

+ Shows that the fall was above the average ; — that it was below it.
a and 27. b and 26. c and 25. d and 19, 24. e and 30.

SUPPLEMENTARY RAINFALL, AUGUST, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	...	XI.	Llandefaelog-fach.....	5·15
II.	Dorking, Abinger Hall .	5·97	,,	New Radnor, Ednol.....	6·38
,,	Sheppey, Leysdown	2·25	,,	Rhayader, Nantgwillt...	8·55
,,	Hailsham	4·04	,,	Lake Vyrnwy	7·51
,,	Crowborough.....	4·76	,,	Ruthin, Plâs Drâw	3·71
,,	Ryde, Beldornie Tower..	3·71	,,	Criccieth, Talarvor	5·69
,,	Bournemouth, Kempsey	3·65	,,	I. of Anglesey, Lligwy..	3·87
,,	Emsworth, Redlands ...	5·59	,,	Douglas, Woodville.....	3·95
,,	Alton, Ashdell	3·76	XII.	Stoneykirk, Ardwell Ho.	4·13
,,	Newbury, Welford Park	3·90	,,	Dalry, Old Garroch	8·95
III.	Oxford, Magdalen Coll..	3·78	,,	Moniaive, Maxwelton Ho.	7·66
,,	Banbury, Bloxham	3·51	,,	Lilliesleaf, Riddell	3·53
,,	Pitsford, Sedgebrook ...	3·56	XIII.	N. Esk Res. [Penicuick]	4·85
,,	Huntingdon, Brampton.	3·05	XIV.	Dalry, Blair	9·38
,,	Wisbech, Bank House...	3·47	,,	Glasgow, Queen's Park..	6·28
IV.	Southend	2·60	XV.	Inveraray, Newtown ...	10·95
,,	Colchester, Lexden	3·87	,,	Ballachulish, Ardsheal...	11·94
,,	Saffron Waldon, Newport	3·08	,,	Campbeltown, Redknowe	6·69
,,	Rendlesham Hall	3·70	,,	Islay, Eallabus.....	7·13
,,	Swaffham	3·32	XVI.	Dollar.....	5·49
V.	Salisbury, Alderbury ...	3·70	,,	Balquhidder, Stronvar...	10·69
,,	Bishop's Cannings	3·47	,,	Coupar Angus Station...	4·19
,,	Ashburton, Druid House	5·19	,,	Blair Atholl	5·32
,,	Okehampton, Oaklands.	4·94	,,	Montrose, Sunnyside ...	4·46
,,	Hartland Abbey	5·38	XVII.	Alford, Lynturk Manse..	3·80
,,	Lynmouth, Rock House	4·63	,,	Keith H.R.S.....	4·72
,,	Probus, Lamellyn	4·08	XVIII.	Fearn, Lower Pitkerrie..	3·34
,,	Wellington, The Avenue	2·92	,,	S. Uist, Askernish	5·38
,,	North Cadbury Rectory	3·27	,,	Invergarry.....	9·19
VI.	Clifton, Pembroke Road	4·39	,,	Aviemore, Alvie Manse.	4·03
,,	Ross, The Graig	3·53	,,	Loch Ness, Drumnadrochit	3·29
,,	Shifnal, Hatton Grange	4·82	XIX.	Invershin	5·96
,,	Wem Rectory	4·43	,,	Bettyhill	5·75
,,	Cheadle, The Heath Ho.	5·43	,,	Watten H.R.S.....	5·57
,,	Coventry, Kingswood ...	3·67	XX.	Cork, Wellesley Terrace	4·46
VII.	Market Overton	5·00	,,	Killarney, District Asyl.	4·64
,,	Grantham, Stainby	4·89	,,	Glenam [Clonmel]	4·76
,,	Horncastle, Bucknall ...	4·28	,,	Ballingarry, Hazelfort...	4·59
,,	Worksop, Hodsock Priory	5·01	,,	Miltown Malbay	6·76
VIII.	Neston, Hinderton	3·11	XXI.	Gorey, Courtown House	4·22
,,	Southport, Hesketh Park	4·18	,,	Moynalty, Westland ...	6·05
,,	Chatburn, Middlewood.	...	,,	Athlone, Twyford	6·46
,,	Duddon Val., Seathwaite Vic.	10·36	,,	Mullingar, Belvedere ...	6·68
IX.	Langsett Moor, Up. Midhope	5·10	XXII.	Woodlawn	8·07
,,	Baldersby	2·09	,,	Westport, Murrisk Abbey	9·24
,,	Scalby, Silverdale	2·39	,,	Crossmolina, Enniscoe ..	7·68
,,	Ingleby Greenhow Vic..	2·10	,,	Collooney, Markree Obs.	7·58
,,	Middleton, Mickleton ...	3·80	XXIII.	Enniskillen, Portora ...	5·13
X.	Beltingham	3·66	,,	Warrenpoint.....	4·81
,,	Bamburgh	3·37	,,	Banbridge, Milltown ...	5·08
,,	Keswick, The Bank.....	8·10	,,	Belfast, Springfield	...
,,	Melmerby Rectory	4·43	,,	Bushmills, Dundarave..	5·28
XI.	Llanfrechfa Grange	5·89	,,	Stewartstown	5·96
,,	Treherbert, Tyn-y-wann	13·45	,,	Killybegs	11·68
,,	*Castle Malgwyn*	5·48	,,	Horn Head	6·56

METEOROLOGICAL NOTES ON AUGUST, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—Another wet and cool month, for the greater part stormy and inclement. Thundery weather prevailed on the 9th and 10th, and exceptionally heavy R occurred on 11th and 24th. Mean temp. 60°·7, or 1°·4 above the average.

ABINGER HALL.—A very remarkable month, with a record fall of 1·98 in. on 24th, 1·62 in. falling from 9 a.m. to 5 p.m. Harvest operations were much hindered and corn discoloured.

TENTERDEN.—The first week was fine and the rest mostly wet and very bad for harvest. A great deal of wind at times. TSS on 10th.

SHEPPEY, LEYSDOWN.—Altogether cheerless and sunless. Fine during the first week, then rainy and unsettled.

CROWBOROUGH.—Heavy R, high winds and storms, doing damage to crops. Sharp gale on 20th. Mean temp. 57°·7, or 2°.3 below the average.

EMSWORTH, REDLANDS.—R 3·13 in. in excess of the average of 19 years. On 24th 1·02 in. of R fell in 55 minutes. Continuous gales.

HARTLEY WINTNEY.—Cold and wet, with R almost daily and rough S.W. winds. TS on 11th. This month completes the average total R for the year.

BURY ST. EDMUNDS, WESTLEY.—Most unfavourable for harvest work. Corn was not so much damaged as last year, the month being cold and windy.

NORWICH, BRUNDALL.—Mean temp. 1°·8 below the average. Although it was a cool and unsettled month, the mean temp. was 0°·8 higher than in August, 1902, and the R ·65 in. less.

SWAFFHAM.—On the 1st ·33 in. of R fell in about 15 minutes.

WINTERBOURNE STEEPLETON.—The R was the highest and the mean. temp. the lowest during eleven years' observations. The weather was nearly as bad for the harvest as in 1902, when 4·39 in. of R fell in August.

TORQUAY, CARY GREEN.—R ·77 in. above the average. Duration of sunshine 196·3 hours, or 10·0 hours below the average. Mean temp. 59°·9, or 1°·7 below the average. Mean amount of ozone 4·9; max. 7·0 on 15th with W. wind and on 27th with S.W. wind; min. 2·0 on 2nd with N.W. wind.

OKEHAMPTON, OAKLANDS.—Very wet and unseasonable, with low temp. Most unfavourable for harvest work.

WELLINGTON, THE AVENUE.—Very stormy and unsettled almost throughout, the wind at times being very violent. Only on four days did the temp. rise to 70°. R, although very frequent, only ·25 in. above the normal.

NORTH CADBURY RECTORY.—Most miserable. A rainy and cloudy month. The max. temp. was below 70° on 14 days, and there were many cool nights. The amount of wind was very great.

ROSS, THE GRAIG.—Till the 12th fine and pleasant, only ·14 in. of R falling in a fortnight. The next 12 days were just the contrary, with great R, blackness and gloom, and disastrous for corn harvest.

WEM, THE RECTORY.—A very melancholy month; cold, damp and almost sunless.

BOLTON, THE PARK.—Changeable, with frequent R and low temp. Mean temp. 54°·8, or 2°·5 below the average. Bright sunshine on 24 days, the total being 133 hours 50 mins., or 4 hours 50 mins. below the average. Severe TS with vivid L on 14th.

HULL, PEARSON PARK.—Mild and genial early in the month, but from 14th very unsettled with frequent R and much wind. Very cloudy throughout.

BAMBURGH.—Very unsettled. High N.W. winds and few warm days.

WALES AND THE ISLANDS.

HAVERFORDWEST.—Remarkable for the number of wet days, absence of sunshine and low temp., which not once reached 70° and seldom exceeded 63°.

One of the wettest Augusts of recent years. Crops much damaged. Duration of sunshine 154 hours.

DOUGLAS, WOODVILLE.—Probably the worst month of a generally disastrous summer. Cold, wet and unsettled, with remarkably low bar. R fell on 24 days, but the total was not excessive. Gales were unusually frequent, doing much damage. L on 14th and T on 24th.

SCOTLAND.

CARGEN [DUMFRIES].—Cold, wet and changeable. Harvest prospects poor. T and L on 14th and 23rd and T on 6th.

TIGHNABRUAICH.—The clouds were highly charged with electricity and sheet lightning was a common phenomenon. The R exceeded all records for a summer month.

BALLACHULISH, ARDSHEAL.—The wettest August recorded at this station. R 5·11 in. above the average.

STRONVAR.—Only one dry day and everything in the way of crops is far backward.

COUPAR ANGUS.—August, generally the wettest month, has been no exception this year. TS8 were numerous and in some cases severe. Mean temp. 54°·0, or 3°·5 below the average; the lowest since 1888.

ABERDEEN, CRANFORD.—Wet, with little sunshine. T and L almost every day.

DRUMNADROCHIT.—R 1·10 in. above the average, while the number of rainy days beats the record for the month.

BETTYHILL.—With the exception of a few days and an occasional half-day of sunshine, this was a very wet month.

IRELAND.

CORK, WELLESLEY TERRACE.—Critically speaking, we had no summer, the mean temp. having been little over that of autumn. Owing to the excessive R and low temp. the harvest prospects are very unfavourable. R ·97 in. above the average.

DARRYNANE ABBEY.—Very wet and harvest very backward. Hay and oats still in the fields and much damaged.

MILTOWN MALBAY.—More or less R every day, a visitation almost unexampled. Harvest business in a deplorable state.

DUBLIN, FITZWILLIAM SQUARE.—Unsettled, cool, rainy and windy. The R was remarkable for frequency rather than quantity, and the force of the wind was unusual for the time of year. Severe TS on 24th, with T and L of exceptional violence. Mean temp. 58°·4, or 1°·3 below the average. The shade temp. rose above 70° on one day only. High winds were noted on 18 days, reaching the force of a gale on 5.

BALLINASLOE.—This was the first time in 32 years that R fell on every day of the month.

MARKREE OBSERVATORY.—Very wet; at times very heavy R fell with frequent TS8. Some high wind, reaching the force of a gale on 5 or 6 days.

KILLYBEGS.—The R has only been exceeded since 1886 by that of November, 1890, when 12·36 in. fell.

HORN HEAD.—On the 8th ·32 in. of R fell in 15 minutes. accompanied by T.

OMAGH, EDENFEL.—The R of the past month, 7·92 in., was the heaviest ever registered in the same period, and brought the R of the 8 months to 36·39 in., almost exactly the full average fall for a whole year. Every other characteristic of the weather was equally unsettled and unfavourable; in fact, August, 1903, will be remembered as the most unsummerlike summer month ever recorded here.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1903.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	67·9	25	29·9	11*a*	53·9	39·5	39·7	78	102·9	23·5	2·30	18	5·3
Malta	67·9	26	45·0	10	61·8	51·0	48·4	79	119·6	39·3	·88	8	3·3
Lagos, W. Africa	93·0	8	70·0	19	90·3	78·4	76·9	78	143·0	70·0	1·86	3	...
Cape Town	88·0	15	50·0	7, 20	74·7	57·6	53·0	66	...	...	1·34	6	3·3
Durban, Natal	90·7	1, 30	55·6	21	82·7	64·4	...	...	146·3	...	4·13	12	4·1
Mauritius	87·6	5, 6	70·8	31	84·7	74·5	73·3	83	155·5	65·6	7·49	22	6·7
Calcutta	99·9	30	62·1	10	91·1	70·0	64·9	61	151·1	55·9	·77	2	2·3
Bombay	87·7	29	64·3	9	83·8	70·6	66·9	73	133·0	55·3	·17	1	0·6
Madras	98·6	31	67·2	4	89·9	72·6	72·1	78	141·9	63·3	·00	0	1·2
Kodaikanal	74·5	23	46·9	2	70·6	51·4	41·6	53	144·8	32·2	·29	1	2·7
Colombo, Ceylon	94·0	14	72·8	9	82·4	75·6	73·3	75	152·4	70·8	2·53	5	1·9
Hongkong	79·8	11	56·2	1	70·1	63·0	63·1	89	130·7	...	2·66	14	8·8
Melbourne	99·8	2	43·2	24	77·1	55·4	53·0	66	155·0	33·1	2·93	9	5·8
Adelaide	97·5	1	46·9	25	79·2	59·0	50·7	52	153·3	40·9	2·20	8	4·4
Coolgardie	100·3	2	43·2	8	84·5	56·0	47·0	44	166·2	37·2	·00	0	1·9
Sydney	94·1	23	59·4	15	78·2	66·6	63·8	78	135·0	53·0	3·78	18	5·9
Wellington	74·0	6	43·0	22	65·6	52·6	49·5	71	126·0	29·0	1·95	12	5·4
Auckland	76·5	11	49·0	13	69·9	56·3	51·3	65	150·0	44·0	1·38	8	3·6
Jamaica, Negril Point	89·4	1	61·9	16	85·1	68·9	68·6	75	...	...	·57	3	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	87·8	31	69·6	13	84·3	73·0	69·2	73	157·2	...	2·48	12	2·5
Toronto	68·4	19	15·9	1	46·5	32·7	33·9	80	80·0	13·7	1·83	11	7·2
Fredericton, N.B.	58·2	14	—4·4	3	43·8	22·8	22·0	59	...	...	6·07	12	5·8
Winnipeg	41·1	11	—10·3	14	27·9	7·7	...	...	...	...	1·08	10	5·9
Victoria, B.C.	55·7	23	26·4	12	47·0	35·5	...	...	...	...	2·71	13	5·6
Dawson	34·8	18	—31·8	9	16·9	—4·5	...	...	...	...	·60	4	4·1
					a—and 12.								
Lagos January	92·0	20, 22, 25, 31	68·0	1	88·9	77·2	...	...	142·0	...	·00	0	...
Lagos February	92·0	14	69·0	1	87·2	74·7	74·0	78	137·0	...	3·41	3	...

MALTA.—Mean temp. of air 55°·4, or 0°·5 below and mean hourly velocity of wind 10·9 or 0·2 below, averages. Mean temp. of sea 61°·6.

Mauritius.—Mean temp. of air 1°·5 and dew point 2°·5 above, and R ·71 in. below, averages. Mean hourly velocity of wind 10·2 miles, or 0·3 below average; extremes 24·7 on 10th and 1·6 on 31st; prevailing direction E.

KODAIKANAL.—Mean temp. of air 59°·0. Mean velocity of wind 275 miles per day. Bright sunshine 250·9 hours.

COLOMBO.—Mean temp. of air 83°·8, or 1°·8 above, of dew point 0°·1 above, and R 2·29 in. below, averages. Mean hourly velocity of wind 5·7 miles, mean direction S.W.

HONGKONG.—Mean temp. of air 66°·3 or 4°·1 above, R 0·60 in. below, averages. Sunshine 64·3 hours. Mean hourly velocity of wind 15·0 miles; prevailing direction E.

Adelaide.—Mean temp. of air 1°·2 below, R 1·14 in. above, 46 years' average. Cool, with good agricultural rains during the first week.

Sydney.—Mean temp. of air 3°·1 above and R 1·31 in. below, averages.

Wellington.—Mean temp. of air 3°·0 below, and R 1·59 in. below, averages.

SYMONS'S

METEOROLOGICAL MAGAZINE.

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THE SOUTHPORT MEETING OF THE BRITISH ASSOCIATION.

THE 1903 meeting of the British Association for the Advancement of Science stands out from the seventy-two that have gone before it on account of the remarkable prominence given to Meteorology. This was largely due to the happy inspiration of holding the meeting of the International Meteorological Committee at the same time and place, and thereby securing the presence of official representatives of Meteorology from almost all civilised countries.

Southport proved a most attractive meeting place. Although the gale and torrential rain of the night of September 10th will not soon be forgotten by those exposed to them, the porous, sandy soil on which the town is built speedily absorbed all traces of the deluge.

The Fernley Observatory has been known by reputation to British meteorologists for many years, but the completeness and perfection of the meteorological equipment came as a surprise to most of the visitors. The utmost credit is due to Mr. Baxendell and his able assistant Mr. Halliwell for the sound scientific plan on which the observations are made and published, and many observers both private and official carried away valuable lessons as to what was possible and feasible. We hope to have a full account of this model observatory in an early number.

The town itself was bright and cheerful, shaded by trees in the day-time, the pavements of the principal streets sheltered from rain by glass arcades, and at night it was illuminated by innumerable coloured electric lights fitted up among the branches. The meeting rooms were commodious and conveniently arranged, and the meteorological exhibition occupied a prominent place.

In the descriptions of British Association meetings in these pages it has been usual to give as complete a list as possible of the meteorologists and observers present, but we have not space this year to print such a list in full. It must suffice to place on record those who took part in the Meteorologists' Breakfast, a gathering of early birds which on this occasion reached the unprecedented (though familiar) number of **62**. The Breakfast was held in the Queen's Hotel on Tuesday, September 15th, at the appropriate hour of 9 a.m.

All the members of the International Meteorological Committee then in Southport and the President of the Association, Sir Norman Lockyer, were present as guests. The following is a complete list, members of the International Committee being distinguished by small capitals:—

Ackroyd, W. T. (Halifax)
Amery, P. Fabyan S. (Ashburton)
Archibald, Douglas (London)
Aspland, W. G. (Newton Abbot)
Biggs, J. H. W. (Liverpool)
Black, Surg.-Maj. W.G. (Edinburgh)
Bolton, John (London)
Boltzmann, Prof. L. (Vienna)
Brodie, F. J. (London)
Buchan, Dr. A., F.R.S. (Edinburgh)
Creak, Capt. E. W., R.N., F.R.S. (London)
Crowley, F. (Ashdell, Alton)
Dines, W. H. (Oxshott)
Edmonds, F. B. (London)
Fream, Prof. W. (Salisbury)
Glazebrook, Dr. R. T., F.R.S. (Teddington)
Halliwell, F. L. (Southport)
Harmer, F. W. (Norwich)
Hardman, S. (Southport)
HELLMANN, PROF. G. (Berlin)
Herbertson, Dr. A. J. (Oxford)
HERGESELL, PROF. H. (Strasburg)
HILDEBRANDSSON, PROF. H. H. (Upsala)
Hinks, A. R. (Cambridge)
Hopkinson, John (Watford)
Hoyle, W. E. (Manchester)
Kitto, E. (Falmouth)
Larmor, Prof. J., F.R.S. (Cambridge)
Lempfert, R. G. K. (London)
Lockyer, Sir Norman, K.C.B., F.R.S. (London)
Lockyer, Dr. W. J. S. (London)
Lodge, Sir Oliver, F.R.S. (Birmingham)
Mackinder, H. J. (Oxford)
Marriott, W. (London)
MASCART, PROF. E. (Paris)
Mill, Dr. H. R. (London)
MOHN, PROF. H. (Christiania)
MOORE, PROF. WILLIS L. (Washington)
Morrison, G. J. (London)
Parker, Rev. Dr. Dunne (Stevenage)
PAULSEN, DR. A. (Copenhagen)
PERNTER, PROF. M. (Vienna)
Pircher, Dr. J. (Vienna)
Rotch, Dr. A. L. (Blue Hill Observatory, Massachusetts).
Russell, The Hon. Rollo (Haslemere)
RYKATCHEFF, GENERAL (St. Petersburg)
Sampson, R. A. (Durham)
Schuster, Prof., F.R.S. (Manchester)
SHAW, DR. W. N., F.R.S. (London)
Simpson, Dr. J. Y. (Edinburgh)
Smith, J. (Crathes)
Smyth, John (Banbridge)
SNELLEN, DR. M. (Utrecht)
Sopp, E. J. B. (Southport)
Southall, H. (Ross)
TEISSERENC DE BORT, M. L. (Paris)
Turner, Prof. H. H., F.R.S. (Oxford)
VAN BEBBER, DR. (Hamburg)
Warner, A. (Croydon)
Watts, Prof. W. W. (Birmingham)
Wilson, C. T. R. (Cambridge)
Whipple, R. S. (Cambridge)

Before the meal commenced, Dr. H. R. Mill explained that there was no chairman and no formality, for this was merely a spontaneous social gathering of students of the weather, but on this occasion the unofficial meteorologists of the British Isles were happy to have the opportunity of welcoming as guests the official meteorologists of the world. M. Mascart, of Paris, Chairman of the International Meteorological Committee, and Professor Willis Moore of the United States Weather Bureau expressed their appreciation of the courtesy done them, and Dr. W. N. Shaw, as the British representative on the International Committee, also said a few words. Mr. Marriott expressed the regret of Captain D. Wilson-Barker, President of the Royal Meteorological Society, and of Mr. Joseph Baxendell of the Fernley Observatory, at their inability to be present. A successful photograph of the party was taken while breakfast was in progress,

and by the kindness of the photographer, Mr. J. A. Kay, of Southport, we hope to publish a reduction of it in an early issue.

A novel exhibition was given on the esplanade on two successive evenings by Professor Pernter of Vienna, who brought with him one of the great funnel-shaped cannons used in Austria and Italy for the purpose of discharging large vortex rings into the air with the expectation of averting hail. Professor Pernter did not exhibit the apparatus as a hail-preventer, but merely in order to show the production of large vortex rings. Unfortunately the only powder which could be procured did not produce enough smoke to make the rings clearly visible; but though not seen well they were heard very distinctly as they hurtled through the air, the gun being fired in a horizontal position.

We hope in our next number to give some account of the Meteorological Exhibition, and also an epitome of the meteorological papers read at the meeting. Meanwhile we have pleasure in reproducing the greater part of Dr. W. N. Shaw's admirable address as Chairman of the Sub-section of Section A devoted to Astronomy and Meteorology.

METHODS OF METEOROLOGICAL INVESTIGATION.

By W. N. Shaw, Sc.D., F.R.S.

In opening the proceedings of the Sub-section devoted to Cosmical Physics, which we may take to be the application of the methods and results of Mathematics and Physics to problems suggested by observations of the Earth, the air, or the sky, I desire permission to call your attention to some points of general interest in connection with that department which deals with the air. . . . .

But this is not the first occasion upon which the Address from the Chair of the Sub-section has been devoted to Meteorology. Many of you will recollect the trenchant manner in which a university professor, himself a meteorologist, an astronomer, a physicist, and a mathematician, dealt candidly with the present position of Meteorology. After that Address I am conscious that I have no claim to be called a meteorologist according to the scientific standard of Section A. Professor Schuster has explained—and I cannot deny it—that the responsible duty of an office from which I cannot dissociate myself is signing weather reports; and I could wish that the duty of making the next Address had been entrusted to one of my colleagues from across the sea. But as Professor Schuster has set forth the aspect of official meteorology as seen from the academic standpoint with a frankness and candour which I think worthy of imitation, I shall endeavour to put before you the aspect which the relation between Meteorology and academic science wears from the point of view of an official meteorologist whose experience is not long enough to have hardened into that most comfortable of all states of mind, a pessimistic contentment.

Meteorology occupies a peculiar position in this country. From the point of view of Mathematics and Physics, the problems which the subject presents are not devoid of interest, nor are they free from that difficulty which should stimulate scientific effort in academic minds. They afford a most ample field for the display of trained intellect, and even of genius, in devising and apply-

ing theoretical and experimental methods. And can we say that the work is unimportant? Look where you will over the countries which the British Association may be supposed to represent, either directly or indirectly, and say where a more satisfactory knowledge of the laws governing the weather would be unimportant from any point of view. Will you take the British Isles on the eastern shores of the Atlantic, the great meteorological laboratory of the world, with the far-reaching interests of their carrying trade; or India, where the phenomena of the monsoon show most conspicuously the effects of the irregular distribution of land, the second great meteorological cause, and where recurring famines still overstrain the resources of administration. Take the Australasian Colonies and the Cape, which, with the Argentine Republic, where Mr. Davis is developing so admirably the methods of the Weather Bureau, constitute the only land projections into the great southern ocean, the region of "planetary meteorology;" Australia, with its periods of paralysing drought; the Cape, where the adjustment of the crops to climate is a question of the hour; or take Canada, which owns at the same time a granary of enormous dimensions and a large portion of the Arctic Circle; or take the scattered islets of the Atlantic and Pacific, or the shipping that goes wherever ships can go. The merest glance will show that we stand to gain more by scientific knowledge, and lose more by unscientific ignorance of the weather, than any other country. The annual loss on account of the weather would work out at no inconsiderable sum per head of the population, and the merest fraction of success in the prevention of what science must regard as preventable loss would compensate for half a century of expenditure on meteorological offices. Or take a less selfish view and consider for a moment our responsibilities to the general community of nations, the advantages we possess as occupying the most important posts of observation. If the meteorology of the world were placed, as perhaps it ought to be, in the hands of an International Commission, it can be no exaggeration to say that a considerable majority of the selected sites for stations of observation would be on British soil or British ships. We cannot help being the most important agency for promoting or for obstructing the extension of meteorological science. I say this bluntly and perhaps crudely because I feel sure that ideas not dissimilar from these must occasionally suggest themselves to every meteorologist, British or foreign; and if they are to be expressed—and I think you will agree me that they ought to be—a British meteorologist ought to take the responsibility of expressing them.

And how does our academic organisation help us in this matter of more than parochial or even national importance? There was a time when Meteorology was a recognised member of the large physical family and shared the paternal affection of all professors of Physics; but when the poor nestling began to grow up and develop some individuality electricity developed simultaneously with the speed of a young cuckoo. The professors of Physics soon recognised that the nest was not large enough for both, and with a unanimity which is the more remarkable because in some of these academic circles utilitarianism is not a condition of existence, and pure science, not market value, might be the dominant consideration—with singular unanimity the science which bears in its left hand, if not in its right, sources of wealth beyond the dreams of avarice was recognised as a veritable Isaac, and the science wherein the fruits of discovery must be free for all the world, and in which there is not even the most distant prospect of making a fortune—that science was ejected as an Ishmael.

Electrical engineering has an abundance of academic representatives; brewing has its professorship and its corps of students, but the specialised physics of the atmosphere has ceased to share the academic hospitality. So far as I know the British universities are unanimous in dissembling their love for Meteorology as a science, and if they do not actually kick it downstairs they are at least content that it has no encouragement to go up. In none is there a professorship, a lectureship, or even a scholarship, to help to form the nucleus of that corps of students which may be regarded as the primary condition of scientific development.

Having cut the knot of their difficulties in this very human but not very humane method, the universities are, I think, disposed to adopt a method of justification which is not unusual in such cases; indications are not wanting which disclose an opinion that Meteorology is, after all, not a science. There are, I am aware, some notable exceptions; but do I exaggerate if I say that when university professors are kind enough to take an interest in the labours of meteorologists, who are doing their best amid many discouragements, it is generally to point out that their work is on the wrong lines; that they had better give it up and do something else? And the interest which the universities display in a general way is a good-humoured jest about the futility of weather prophecy, and the kindly suggestion that the improvement in the prediction of the next twenty-four hours' weather is a natural limit to the orbit of an Ishmaelite's ambition. . . . . It is quite possible that the unformulated opinion of the vast majority of people in this country who are only too familiar with the meteorological vagaries of the British Isles is that the weather does just as it pleases; that any day of the year may give you an August storm or a January summer's day; that there are no laws to be discovered, and that the further prosecution of so unsatisfactory a study is not worth the time and money already spent upon it. They forget that there are countries where, to judge by their languages, the weather has so nearly the regularity of "old time" that one word is sufficient to do duty for both ideas. They forget that our interests extend to many climates, and that the characteristics of the eastern shores of the North Atlantic are not appropriate to, say, western Tropical Africa. That may be a sufficient explanation of the attitude of the man in the street, but as regards the British universities dare I offer the difficulty of the subject as a reason for any want of encouragement? Or shall I say that the general ignorance on the part of the public of the scientific aspirations and aims of meteorologists and of the results already obtained is a reason for the universities to keep silence on the subject? With all respect I may say that the aspect which the matter presents to official meteorologists is that the universities are somewhat oblivious of their responsibilities and their opportunities.

I have no doubt that it will at once be said that Meteorology is supported by Government funds, and that alma mater must keep her maternal affection and her exiguous income for subjects that do not enjoy State support. I do not wish just now to discuss the complexities of alma mater's housekeeping. I know she does not adopt the same attitude with regard to astronomy, physics, geology, mineralogy, zoology, or botany, but let that pass. From the point of view of the advancement of science I should like to protest against the idea that the care of certain branches of science by the State and by the universities can be regarded as alternative. The advancement of science

demands the co-operation of both in their appropriate ways. As regards Meteorology, in my experience, which I acknowledge is limited, the general attitude towards the department seems to be dictated by the consideration that it must be left severely alone in order to avoid the vicious precedent of doing what is, or perhaps what is thought to be, Government work without getting Government pay, and the result is an almost monastic isolation.

There is too much isolation of scientific agencies in this country. You have recently established a National Physical Laboratory the breath of whose life is its association with the working world of physics and engineering, and you have put it—where? At Cambridge, or anywhere else where young physicists and engineers are being trained? No; but in the peaceful seclusion of a palace in the country, almost equidistant from Cambridge, Oxford, London, and everywhere else. You have established a Meteorological Office, and you have put it in the academic seclusion of Victoria Street. What monastic isolation is good for I do not know. I am perfectly certain it is not good for the scientific progress of Meteorology. How can one hope for effective scientific development without some intimate association with the institutions of the country, which stand for intellectual development and the progress of science?

I could imagine an organisation which by association of the universities with a central office would enable this country, with its colonies and dependencies, to build up a system of meteorological investigation worthy of its unexampled opportunities. But the co-operation must be real and not one-sided. Meteorology, which depends upon the combination of observations of various kinds from all parts of the world, must be international, and a Government department in some form or other is indispensable. No university could do the work. But whatever form Government service takes it will always have some of those characteristics which, from the point of view of research, may be called bondage. On the other hand, research, to be productive, must be free with an academic freedom, free to succeed or fail, free to be remunerative or unremunerative, without regard to Government audits or House of Commons control. Research looks to the judgment of posterity with a faith which is not unworthy of the Churches, and which is not among those excellent moral qualities embodied in the Controller and Auditor General. *Die academische Freiheit* is not the characteristic of a Government department. The opportunity which gave to the world the "Philosophiæ Naturalis Principia" was not due to the State subvention of the Deputy Mastership of the Mint, but to the modest provision of a professorship by one Henry Lucas, of whose pious benefaction Cambridge has made such wonderful use in her Lucasian professors.

The future of Meteorology lies, I believe, in the association of the universities with a central department. I could imagine that Liverpool or Glasgow might take a special interest in the meteorology of the sea; they might even find the means of maintaining a floating observatory; and when I say that we know practically nothing of the distribution of rainfall over the sea, and we want to know everything about the air above the sea, you will agree with me that there is room for such an enterprise. Edinburgh might, from its association with Ben Nevis, be desirous of developing the investigation of the upper air over our land; in Cambridge might be found the author of a book, on the principles of atmospheric physics, worthy of its Latin predecessor: and for London I can assign no limited possibilities.

If such an association were established I should not need to reply to Professor Schuster's suggestion for the suppression of observations. The real requirement of the time is not fewer observations, but more men and women to interpret them. I have no doubt that the first expression of such an organisation would be one of recognition and acknowledgment of the patience, the care, the skill, and the public spirit—all of them sound scientific characteristics—which furnish at their own expense those multitudes of observations. The accumulated readings appal by their volume, it is true, but they are, and must be, the foundation upon which the scientific structure will be built. . . .

Yet with all these achievements it must be confessed that the progress made with the problems of general or dynamical Meteorology in the last thirty years has been disappointing. When we compare the position of the subject with that of other branches of Physics it must be allowed that it still lacks what astronomy found in Newton, sound in Newton and Chladni, light in Young or Fresnel, heat in Joule, Kelvin, Clausius, and Helmholtz, and electricity in Faraday and Maxwell. Above all, it lacks its Kepler. Let me make this clear. Kepler's contribution to physical astronomy was to formulate laws which no heavenly body actually obeys, but which enabled Newton to deduce the law of gravitation. The first great step in the development of any physical science is to substitute for the indescribably complex reality of nature an ideal system that is an effective equivalent for the purposes of theoretical computation. . . . . When we look round the sciences each has its own peculiar ideals and its own physical quantities: astronomy has its orbits and its momentum, sound its longitudinal vibration, light its transverse vibration, heat its energy and entropy, electricity its "quantity" and its wave, but meteorology has not yet found a satisfactory ideal problem to substitute for the complexity of nature. I wish to consider the aspect of the science from this point of view and to recall some of the attempts made to arrive at a satisfactory modification of reality. I do not wish to refer to such special applications of physical reasoning as may be involved in the formation of cloud, the thermodynamics of a mixture of air and water vapour, the explanation of optical or electrical phenomena, nor even Helmholtz's application of the theory of gravitational waves to superposed layers of air of different density. These require only conventions which belong already to physics, and though they may furnish suggestions they do not themselves constitute a general meteorological theory.

The most direct efforts to create a general theory of atmospheric circulation are those which attempt to apply Newtonian dynamics, with its more recent developments on the lines of hydrodynamics and thermodynamics. Attempts have been made, mathematical or otherwise, to determine the general circulation of the atmosphere by the application of some form of calculation, assuming only the sun and a rotating earth, with an atmosphere, as the data of the problem. I confess that these attempts, interesting and ingenious as they are, seem to me to be somewhat premature. The "problem" is not sufficiently formulated. When Newton set to work to connect the motions of the heavenly bodies with their causes, he knew what the motions of the heavenly bodies were. Mathematics is an excellent engine for explaining and confirming what you know. It is very rarely a substitute for observation, and before we rely upon it for telling us what the nature of the general circulation of the atmosphere really is, it would be desirable to find out by observation or

experiment what dynamical and elastic properties must be attributed to an extremely thin sheet of compressible fluid rotating about an axis with a velocity reaching 1000 miles an hour, and subject to periodic heating and cooling of a very complicated character. It would be more in consonance with the practice of other sciences to find out by observation what the general circulation is before using mathematics to explain it. What strikes one most about the mathematical treatises on the general circulation of the atmosphere is that what is true about the conclusions is what was previously known from observation. It is, I think, clear that that method has not given us the working ideal upon which to base our theory.

Consider next the attempts to regard atmospheric phenomena as periodic. Let me include with this the correlation of groups of atmospheric phenomena with each other or with those of the sun, when the periodicity is not necessarily regular, and the scientific process consists in identifying corresponding changes. This method has given some remarkable results by the comparison of the sequence of changes in the meteorological elements in the hands of Petterson and Meinardus, and by the comparison of the variation of pressure in different parts of the globe by Sir Norman Lockyer and Dr. W. J. S. Lockyer; as regards the Earth and the sun the subject has reached the stage of productive discussion.

For the purpose of dealing with periodicity in any form we substitute for nature an ideal system obtained by using mean values instead of individual values, and leaving out what, from this point of view, are called accidental elements. The simplification is perfectly legitimate. Passing on to the consideration of periodicity in the stricter sense the process which has been so effective in dealing with tides, the motions of the liquid layer, is very attractive as a means of attacking the problems of the atmosphere, because, in accordance with a principle in dynamics, to every periodic cause there must correspond an effect of the same period, although the relation of the magnitude of the effect to the cause is governed by the approximation of the natural period of the body to that of the cause.

There are two forms of the strict periodic method. One is to examine the generalised observations for periodicities of known length, whether it be that of the lunar rotations or of sunspot frequency, or of some longer or shorter period. In this connexion let me acknowledge a further obligation to Professor Schuster for tacking on to his Address of last year a development of his work on the detection of hidden periodicities by giving us a means of estimating numerically what I may call the reality of the periodicity. The other method is by harmonic analysis of a series of observations with the view of finding causes for the several harmonic components. I may say that the Meteorological Office, supported by the strong opinion of Lord Kelvin, has favoured that plan, and on that account has for many years issued the hourly results for its observatories in the form of five-day means as representing the smallest interval for which the harmonic analysis could be satisfactorily employed. Sir Richard Strachey has given some examples of its application, and the capabilities of the method are by no means exhausted, but as regards the general problem of dynamic meteorology harmonic analysis has not as yet led to the disclosure of the required generalisation.

I ought to mention here that Professor Karl Pearson, with the assistance of Miss Cave, has been making a most vigorous attempt to estimate the numerical

value of the relationship, direct or inverse, between the barometric readings at different places on the earth's surface. The attempt is a most interesting one as an entirely new departure in the direction of reducing the complexity of atmospheric phenomena. If it were possible to find co-ordinates which showed a satisfactory correlation it might be possible to reduce the number of independent variables and refer the atmospheric changes to the variations of definite centres of action in a way that has already been approached by Hildebrandsson from the meteorological side.

Years ago, when Buys Ballot laid down as a first law of atmospheric motion that the direction of the wind was transverse to the barometric gradient and the force largely dependent upon the gradient, and when the examination of synchronous charts showed that the motion of air could be classified into cyclonic and anticyclonic rotation, it appeared that the meteorological Kepler was at hand, and the first step towards the identification of a working meteorological unit had been taken—the phenomena of weather might be accounted for by the motion and action of the cyclonic depression, the position of the ascending current, the barometric minimum. The individual readings over the area of the depression could be represented by a single symbol. By attributing certain weather conditions to certain parts of the cyclonic area and supposing that the depression travelled with more or less unchanged characteristics, the vagaries of weather changes can be accounted for. For thirty years or more the depression has been closely watched, and thousands of successful forecasts have been based upon a knowledge of its habits. But unfortunately the travelling depression cannot be said to preserve its identity in any sense to which quantitative reasoning can be applied. As long as we confine ourselves to a comparatively small region of the earth's surface the travelling depression is a real entity, but when we widen our area it is subject to such variations of path, of speed, of intensity, and of area, that its use as a meteorological unit is seriously impaired, and when we attempt to trace it to its source or follow it to its end it eludes us. Its origin, its behaviour, and its end are almost as capricious as the weather itself.

Nor if we examine other cases in which a veritable entity is transmitted can we expect that the simple barometric distribution should be free from inexplicable variations. We are familiar with ordinary motion, or, as I will call it, astronomical motion, wave motion, and vortex motion. Astronomical motion is the motion of matter, wave motion the motion of energy, vortex motion the motion of matter with energy, but the motion of a depression is merely the transmission of the locus of transformation of energy; neither the matter nor the energy need accompany the depression in its motion. If other kinds of motion are subject to the laws of conservation of matter and conservation of energy, the motion of the depression must have regard also to the law of dissipation of energy. An atmospheric disturbance, with the production of rainfall and other thermal phenomena, must comply in some way with the condition of maximum entropy, and we cannot expect to account for its behaviour until we can have proper regard to the variations of entropy. But the conditions are not yet in a form suitable for mathematical calculation, and we have no simple rules to guide us. So far as Meteorology is concerned, Willard Gibbs unfortunately left his work unfinished.

When the cyclonic depression was reluctantly recognised as too unstable a creature to carry the structure of a general theory, Mr. Galton's anticyclones,

the areas of high pressure and descending currents, claimed consideration as being more permanent. Professor Köppen and Dr. van Bebber have watched their behaviour with the utmost assiduity and sought to find therein a unit by which the atmospheric changes can be classified; but I am afraid that even Dr. van Bebber must allow that his success is statistical and not dynamical. "High pressures" follow laws on the average, and the quantity we seek is not an average but an individual.

The question arises, whether the knowledge of the sequence of weather changes must elude us altogether, or will yield to further search. Is the man in the street right after all? But consider how limited our real knowledge of the facts of atmospheric phenomena really is. It may very well be that observations on the surface will never tell us enough to establish a meteorological entity that will be subject to mathematical treatment; it may be that we can only acquire a knowledge of the general circulation of the atmosphere by the study of the upper air, and must wait until Professor Hergesell has carried his international organisation so far that we can form some working idea therefrom of general meteorological processes. But let us consider whether we have even attempted for surface meteorology what the patience of astronomers from Copernicus to Kepler did for astronomy.

Do we yet fully comprehend the kinematics of the travelling depression; and if not, are we in a satisfactory position for dealing with its dynamics? I have lately examined minutely the kinematics of a travelling storm, and the results have certainly surprised me and have made it clear that the travelling depressions are not all of one kinematical type. We are at present hampered by the want of really satisfactory self-recording instruments. I have sometimes thought of appealing to my friends the professors of physics who have laboratories where the reading of the barometer to the thousandth of an inch belongs to the work of the "elementary class," and of asking them to arrange for an occasional orgy of simultaneous readings of the barometer all over the country with corresponding weather observations for twenty-four consecutive hours, so that we might really know the relation between pressure, rainfall, and temperature of the travelling depressions; but I fear the area covered would even then hardly be large enough, and we must improve our self-recording instruments.

Then, again, have we arrived at the extremity of our knowledge of the surface circulation of the atmosphere? We know a great deal about the average monthly distribution, but we know little about the instantaneous distribution. It may be that by taking averages we are hiding the very points which we want to disclose.

Let me remind you again that the thickness of the atmosphere in proportion to the Earth's surface is not unsatisfactorily represented by a sheet of paper. Now it is obvious that currents of air in such a thin layer must react upon each other horizontally, and therefore we cannot *à priori* regard one part of the area of the Earth's surface as meteorologically independent of any other part. We have daily synoptic charts for various small parts of the globe, and the Weather Bureau extended these over the northern hemisphere for the years 1875 to 1879; but who can say that the meteorology of the northern hemisphere is independent of that of the southern? To settle that primary question we want a synchronous chart for the globe. As long as we are unable to watch the changes in the globe we are to a certain extent groping in the dark.

A great part of the world is already mapped every day, and the time has now arrived when it is worth while to consider what contributions we can make towards identifying the distribution of pressure over the globe. We may idealise a little by disregarding the local peculiarities without sacrificing the general application. I have put in the exhibition a series of maps showing what approximation can be made to an isochronous chart of the globe without special effort. We are gradually extending the possibility of acquiring a knowledge of the facts in that as in other directions. With a little additional enterprise a serviceable map could be compiled; and when that has been reached, and when we have added to that what the clouds can tell us, and when the work of the Aëronautical Committee has so far progressed that we can connect the motion of the upper atmosphere with the conditions at the surface, when we know the real kinematics of the vertical and horizontal motion of the various parts of a travelling storm, we shall, if the universities will help us, be able to give some rational explanation of those periodic relations which our solar physics friends are identifying for us, and to classify our phenomena in a way that the inheritors of Kepler's achievements associated with us in this Section may be not unwilling to recognise as scientific.

Correspondence.

SUN PILLAR.

To the Editor of Symons's Meteorological Magazine.

IT may interest your readers to know that I saw a sun pillar on Thursday, the 17th instant, at 6.20 p.m., when travelling by train between Waterloo and Wimbledon. The sky was nearly covered with high stratus cloud. The sun itself was not visible, but the pillar was seen as a vertical shaft of light of a pale pink colour through a gap in the cloud just above the sun. The phenomenon lasted about fifteen minutes.

FRANCIS DRUCE.

65, Cadogan Square, S.W., 28th September, 1903.

THE GALE OF SEPTEMBER 10TH.

To the Editor of Symons's Meteorological Magazine.

IN case you should be collecting any particulars with respect to the recent severe gale, I write to say that judging from the amount of rain I recorded here at 9 a.m. on 11th inst., the centre of the disturbance must have passed almost directly over the north-west coast of Anglesey. The amount in question was 2·07 in., as against 1·56 in. recorded at Holyhead, which is the maximum fall I have seen returned. No less than ·82 in. fell here between 5 and 7 p.m. on 10th, at which latter hour the barometer stood at 28·83 in., and at 8 p.m., when a rise had commenced, the direction of the wind, which blew with almost hurricane force, was about N.N.E.

BOSTON.

Lligwy, Moelfre, Anglesey, 13th September, 1903.

To the Editor of Symons's Meteorological Magazine.

THOUGH the force of the gale on Thursday, September 10th, was only moderate in this district, the fall of the barometer was extremely rapid, and is worthy of note :—

From 4 p.m. to 10 p.m., Sept. 10th, the fall was 0·645 in.

The most rapid portions of this fall were :—

From 4 to 5 p.m.	0·185 in.
From 7.55 to 8.5 p.m.	0·065 ,,
From 9.30 to 10 p.m.	0·150 ,,

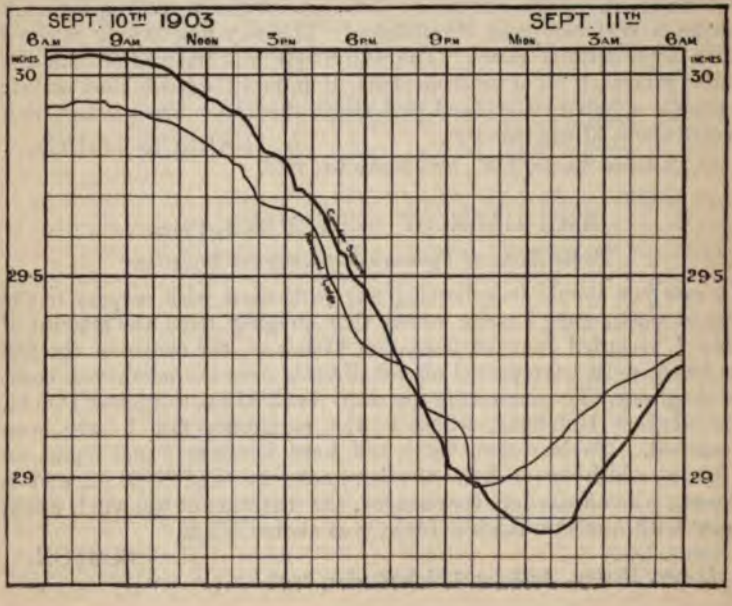
I have nothing which approaches these rates in a nearly complete twelve-year record, 1890-1901, from my Redier barograph. The nearest I can find are :—

1891, October 13th, 2 to 3 p.m., a fall of 0·155 in.
1896, September 25th, in five hours ..... 0·510 ,,

I send you a copy of the trace of my Redier barograph for September 10th, 1903. The lowest point shown on diagram, 28·980, is probably not quite low enough, as the barograph is rather sluggish, but the actual fall cannot have been less rapid, and may have been a little more rapid.

C. L. BROOK.

Harewood Lodge, Meltham, September 12th, 1903.



[To Mr. Brook's tracing of the movements of his Redier barograph at Meltham we add a copy of the curve given by the Redier barograph at Camden Square for the same period. It will be noticed that the range of pressure was greater and the minimum occurred later in London than in Yorkshire. The fall at Camden Square was from 30·008 in. at 9 a.m. on September 10th to 28·830 in. at 1 a.m. on the 11th, a fall of no less than 1·178 in. in sixteen hours. The recovery of pressure was somewhat more rapid than at Meltham. The storm was a peculiarly violent one, and yielded heavy falls of rain over a large part of England.—ED. *S.M.M.*]

To the Editor of Symons's Meteorological Magazine.

YOU will have plenty of reports of Thursday night's gale, but it may be of interest to note the effect on trees and hedges and almost all vegetation in this district. Everything is scorched brown; even the nettles and brambles are blackened, and the foliage of the large trees (what remains to them) is curled and shrivelled up, and this even at Studland and places on the lee side of the downs.

The wind was from S.W., and I hardly thought salt spray could have been carried so far across the land, and so much rain fell too in the night. It was very cold, and if it had been a hard frost there could hardly have been more havoc. In the lanes one is ankle-deep in green leaves torn off. I think I never saw such wholesale destruction in so short a time—trees, of course, and large branches down everywhere.

LOUISA M. S. PASLEY.

The Chestnuts, Swanage, 9th September, 1903.

[Mr. D. W. Horner sends us specimens of oak leaves from near Ilfracombe which were blasted by the same storm, the effects of which upon vegetation reached, he says, as far inland as Exeter. Other observers have described similar devastation extending inland from Weston-super-Mare to beyond Cheddar; and it would appear that the force of the gale on the night of September 10th was very exceptional all over the Devon-Cornwall peninsula.—ED. *S.M.M.*]

HEAVY FALL OF RAIN.

To the Editor of Symons's Meteorological Magazine.

DURING a violent thunderstorm here this afternoon, though we were apparently on the western edge, I measured ·82 in. in 19 minutes, from 3.48 to 4.7; the total fall was 1·07 in. in about 1½ hour.

CHARLES P. HOOKER.

Dollarward, Cirencester, September 24th, 1903.

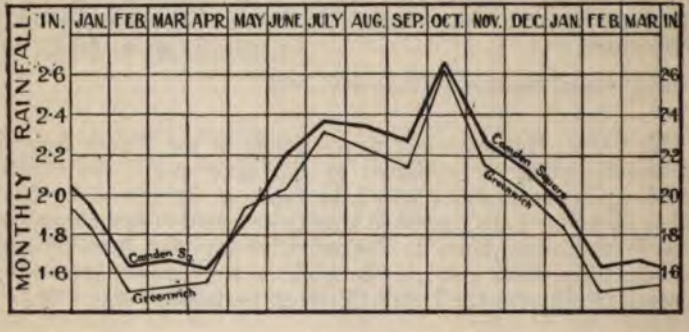
MEAN RAINFALL.

To the Editor of Symons's Meteorological Magazine.

IN an interesting paper appearing in the annual volume of *British Rainfall*, 1902, Mr. Sowerby Wallis has collected some long-period records of rainfall, the mean monthly values of which are also graphically represented in curves. One record is that for Camden Square for the 45 years 1858 to 1902; another is that for Greenwich for the 60 years 1840 to 1899. Considering that 42 out of the 45 years at Camden Square are included in, and indeed form the greater part of, the Greenwich period, the resulting annual curves (given in *British Rainfall*, but scarcely necessary here to repeat) show for these places differences greater than might have been expected. I was thus induced to form mean monthly values at Greenwich for the shorter period 1858 to 1902, and make a more direct comparison. The new Greenwich values for each month of the year are respectively—

1·84 1·50 1·52 1·56 1·92 2·02 2·30 2·23 2·13 2·62 2·17 2·02 in.

Reproducing here Mr. Wallis's 45 years' curve for Camden Square, and adding thereto the curve for the similar period at Greenwich, it is seen that the two curves are not dissimilar, but, on the contrary, in very fair agreement. It seemed to me to be of interest thus to point out how an apparent discrepancy disappears when the period compared is at both places the same.



Again, I have the Greenwich results collected for the 62 years 1841 to 1902. Dividing these into two groups of 31 years each, I find great differences in the annual distribution of rainfall, the mean monthly values in the two series differing in each of the months of January, May, September and December by more than 0·25 in. It is thus difficult to say how long a period is really sufficient to obtain satisfactory mean values.

WILLIAM ELLIS.

September, 1903.

THE NINE MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—September, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	12·88	180	Arncliffe ...+	16·34	138	Braemar	+9·77	141
Tenterden	+4·98	127	Hull	+3·49	120	Aberdeen	+6·90	131
Hartley Wintney	+9·52	154	Newcastle.....	+2·95	116	Cawdor	+3·72	117
Hitchin .....+	11·46	170	Seathwaite +	28·42	131	Glencarron +	14·59	123
Winslow	+9·09	155	Cardiff	+9·23	134	Dunrobin	+5·42	126
Westley.....	+4·75	126	Haverfordwest	+9·79	134	Darrynane ...	+4·83	143
Brundall.....	+4·25	124	Gogerddan +	10·28	135	Waterford ...	+8·08	130
Alderbury	+7·56	141	Llandudno ...	+6·16	130	Broadford.....	+9·45	140
Ashburton .....+	11·28	135	Dumfries ...+	12·89	143	Carlow .....+	11·18	147
Polapit Tamar ...	+8·16	133	Lilliesleaf	+9·06	143	Dublin	+5·90	130
Stroud .....+	10·43	155	Colmonell	+4·14	114	Mullingar...+	11·92	145
Woolstaston ...+	11·28	156	Glasgow ...+	17·01	167	Ballinasloe +	10·56	141
Boston	+6·83	147	Inveraray ...+	13·23	127	Clifden	+7·76	114
Hesley Hall	+4·49	130	Islay	+7·39	124	Crossmolina +	11·66	133
Derby.....	+6·29	138	Mull	+8·18	121	Seaforde	+9·17	136
Bolton	+5·28	118	Loch Leven +	14·78	159	Londonderry..	+4·13	114
Wetherby	+8·86	152	Dundee	+6·83	136	Omagh .....+	12·20	143

September has proved the driest month of the year, except February, though most stations record a fall considerably in excess of the average, and the falls for the nine months vary from 14 to 80 per cent. in excess, the average for the British Isles being probably about 37 per cent. or fully one-third more than the normal fall.

REVIEW.

Instructions to Observers of the Indian Meteorological Department. By J. ELIOT, M.A., F.R.S., &c. Second edition. Calcutta, 1902. Size 10 × 6. Pp. iv. + 120.

THESE instructions apply to the special circumstance of meteorological observers in India, and they bear evidence of being based on experience. The use of a minimum wet-bulb thermometer is recommended, and this is an instance of different conditions making it possible to use an instrument which could not be satisfactorily employed in this country, at least not in winter. The one point which we are inclined to criticise is the recommendation to set the rain gauge, which is provided with a wide foot, in a bed of cement. It would serve the purpose better to use a plain cylindrical gauge which could readily be lifted out of a hollow in a cement block so as to empty the outer can in case of overflow. The method recommended is to break out the wide-based gauge from its cement bed, and reset it when emptied. A simpler plan still would be to use a metal inner can, as in the Snowdon gauge, which could readily be withdrawn in case of the bottle overflowing, but the arrangement is perhaps designed to discourage thieves.

RAINFALL AND TEMPERATURE, SEPTEMBER, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	2·64	+ ·57	1·06	4	13	83·7	2	38·1	17
II.		Tenterden ...	2·37	— ·02	·50	10	17	81·5	2	38·0	12
,,		Hartley Wintney ...	2·27	+ ·07	·59	10	11	80·0	1, 2	35·0	11
III.		Hitchin ...	2·02	— ·11	·60	10	16	80·0	2	38·0	12
,,		Winslow (Addington) ...	1·73	— ·53	·52	10	13	77·0	1	35·0	13
IV.		Bury St. Edmunds (Westley)	3·31	+ ·82	1·12	10	17	83·0	2	38·0	12
,,		Norwich (Brundall) ...	3·69	+ 1·24	1·95	10	20	83·0	2	38·2	18
V.		Winterborne Steepleton ...	3·99	...	1·05	28	15	73·6	1	34·5	13
,,		Torquay ...	3·28	...	·60	24	14	71·9	1	42·2	15
,,		Polapit Tamar [Launceston]..	4·43	+ 1·13	·90	1	20	69·5	1	29·9	15
VI.		Stroud (Upfield) ...	2·58	+ ·14	·60	28	16	71·0	1*a*	39·0	14
,,		Church Stretton (Woolstaston)	3·98	+ 1·57	·83	10	24	69·0	1	38·5	15
,,		Worcester (Diglis Lock) ...	2·95	+ 1·13	·52	29	20	...	...	...	...
VII.		Boston ...	3·03	+ 1·05	·95	10	13	77·0	2	39·0	16
,,		Hesley Hall [Tickhill]...	3·02	+ 1·13	1·25	10	16	72·0	1	36·0	13
,,		Derby (Midland Railway)...	2·70	+ ·69	·90	10	17	75·0	1	35·0	16
VIII.		Bolton (The Park)...	5·81	+ 1·65	1·67	10	20	68·5	23	36·1	16
IX.		Wetherby (Ribston Hall) ...	4·01	+ 1·79	1·20	10	22	...	...	...	...
,,		Arncliffe Vicarage...	6·44	+ 1·26	1·91	8	18	...	...	...	...
,,		Hull (Pearson Park).	3·13	+ ·90	1·26	10	16	73·0	1	32·0	18
X.		Newcastle (Town Moor) ...	2·35	+ ·17	·84	2	16	...	...	...	...
,,		Borrowdale (Seathwaite)...	10·81	— 2·07	3·16	9	19	...	...	31·3	16
XI.	WALES.	Cardiff (Ely)...	4·34	+ ·59	·83	24	18	...	...	...	...
,,		Haverfordwest ...	4·87	+ 1·07	·80	1	19	69·3	20	34·0	15
,,		Aberystwith (Gogerddan) ...	5·73	+ 1·66	1·26	8	15	75·0	24	28·0	14
,,		Llandudno...	4·07	+ 1·20	1·14	10	17	69·0	21*a*	39·0	15
XII.	SCOTLAND.	Cargen [Dumfries] ...	3·80	+ ·05	·93	2	15	67·0	18*a*	30·0	15
XIII.		Edinburgh (Royal Observatory)	2·03	...	·77	2	14	66·2	1	37·1	14
XIV.		Colmonell ...	3·46	— ·53	·76	4	14	69·0	21	32·0	12
XV.		Tighnabruaich	4·05	...	·81	7	15	62·0	18	36·0	13
,,		Mull (Quinish)...	3·22	— 1·90	·52	4	16	...	...	...	...
XVI.		Loch Leven Sluices ...	3·04	+ ·13	·72	3	15	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·30	+ ·07	·75	2	20	66·0	26	34·0	15
XVII.		Braemar	2·65	— ·47	·53	2	16	65·7	23	27·0	15
,,		Aberdeen (Cranford)	3·47	+ ·74	·94	2	23	67·0	26	28·0	14
,,		Cawdor (Budgate) ...	1·95	— 1·14	·48	8	15	...	...	...	...
XVIII		Strathconan [Beauly] ...	2·78	— 1·70	·53	8	9	...	...	...	...
,,		Glencarron Lodge...	5·39	— 3·14	·73	11	16	68·5	24	33·0	14
XIX.		Dunrobin ...	2·31	— ·28	·50	11	13	61·5	6	32·0	14
,,		Castletown...	2·72	...	·56	12	21	67·0	25	35·0	15
XX.	IRELAND.	Darrynane Abbey...	3·48	— ·69	·42	17	22	...	...	...	...
,,		Waterford (Brook Lodge) ...	3·36	+ ·23	·66	29	16	67·0	1	36·0	15
,,		Broadford (Hurdlestown) ...	3·77	+ ·90	·58	10	21	62·0	6*b*	36·0	13
XXI.		Carlow (Browne's Hill) ...	3·45	+ ·72	·90	10	18	...	...	..	...
,,		Dublin (FitzWilliam Square)	3·40	+ 1·28	·97	10	17	67·2	1	37·8	15
XXII.		Ballinasloe	4·30	+ 1·16	1·69	10	23	65·0	22*c*	32·0	14
,,		Clifden (Kylemore)	10·12	+ 3·28	2·10	10	21	...	...	...	...
XXIII		Seaforde...	4·48	+ 1·33	1·33	10	20	68·0	1	33·0	14
,,		Londonderry (Creggan Res.).	2·85	— 1·02	·74	10	16	...	...	...	...
,,		Omagh (Edenfel) ...	3·89	+ ·18	1·10	10	17	65·0	20*d*	36·0	14

+ Shows that the fall was above the average; — that it was below it.

a and 23. b and 18, 20, 24. c and 25. d and 23, 25. e and 17. f and 15. g and 16.

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	...	XI.	Llandefaelog-fach.....	4·74
II.	Dorking, Abinger Hall .	3·97	,,	New Radnor, Ednol.....	4·70
,,	Sheppey, Leysdown	2·46	,,	Rhayader, Nantgwillt...	6·52
,,	Hailsham	2·87	,,	Lake Vyrnwy	7·62
,,	Crowborough.....	2·62	,,	Ruthin, Plâs Drâw	4·85
,,	Ryde, Beldornie Tower..	...	,,	Criccieth, Talarvor	5·57
,,	Bournemouth, Kempsey	2·25	,,	I. of Anglesey, Lligwy..	5·71
,,	Emsworth, Redlands ...	3·94	,,	Douglas, Woodville.....	6·17
,,	Alton, Ashdell	2·84	XII.	Stoneykirk, Ardwell Ho.	3·19
,,	Newbury, Welford Park	2·27	,,	Dalry, Old Garroch	6·24
III.	Oxford, Magdalen Coll..	1·60	,,	Montaive, Maxwelton Ho.	5·01
,,	Banbury, Bloxham	2·07	,,	Lilliesleaf, Riddell	3·07
,,	Pitsford, Sedgebrook ...	2·73	XIII.	N. Esk Res. [Penicuick]	2·70
,,	Huntingdon, Brampton.	1·68	XIV.	Dalry, Blair	4·12
,,	Wisbech, Bank House...	2·93	,,	Glasgow, Queen's Park..	3·32
IV.	Southend	1·52	XV.	Inveraray, Newtown ...	4·61
,,	Colchester, Lexden	2·04	,,	Ballachulish, Ardsheal...	6·09
,,	Saffron Waldon, Newport	3·14	,,	Campbeltown, Redknowe	2·86
,,	Rendlesham Hall	2·23	,,	Islay, Eallabus.....	3·98
,,	Swaffham	4·23	XVI.	Dollar.....	4·11
V.	Salisbury, Alderbury ...	1·87	,,	Balquhidder, Stronvar...	5·44
,,	Bishop's Cannings	2·50	,,	Coupar Angus Station...	2·57
,,	Ashburton, Druid House	5·70	,,	Blair Atholl	2·98
,,	Okehampton, Oaklands.	5·04	,,	Montrose, Sunnyside ...	2·89
,,	Hartland Abbey	3·54	XVII.	Alford, Lynturk Manse..	2·44
,,	Lynmouth, Rock House	4·03	,,	Keith H.R.S.....	2·74
,,	Probus, Lamellyn	3·42	XVIII.	Fearn, Lower Pitkerrie..	1·32
,,	Wellington, The Avenue	3·68	,,	S. Uist, Askernish	2·19
,,	North Cadbury Rectory	2·39	,,	Invergarry.....	4·61
VI.	Clifton, Pembroke Road	3·33	,,	Aviemore, Alvie Manse.	2·88
,,	Ross, The Graig	3·04	,,	Loch Ness, Drumnadrochit	2·85
,,	Shifnal, Hatton Grange	3·68	XIX.	Invershin	2·30
,,	Wem Rectory	3·85	,,	Bettyhill	2·03
,,	Cheadle, The Heath Ho.	6·08	,,	Watten H.R.S.....	2·72
,,	Coventry, Kingswood ...	1·97	XX.	Cork, Wellesley Terrace	4·07
VII.	Market Overton	3·30	,,	Killarney, District Asyl.	5·62
,,	Grantham, Stainby	3·21	,,	Glenam [Clonmel]	3·94
,,	Horncastle, Bucknall ...	2·73	,,	Ballingarry, Hazelfort...	3·00
,,	Worksop, Hodsock Priory	2·84	,,	Miltown Malbay	5·52
VIII.	Neston, Hinderton	4·07	XXI.	Gorey, Courtown House	2·32
,,	Southport, Hesketh Park	5·26	,,	Moynalty, Westland ...	4·43
,,	Chatburn, Middlewood.	6·47	,,	Athlone, Twyford	3·93
,,	Duddon Val., Seathwaite Vic.	9·27	,,	Mullingar, Belvedere ...	4·50
IX.	Langsett Moor, Up. Midhope	5·62	XXII.	Woodlawn	4·32
,,	Baldersby	3·51	,,	Westport, Murrisk Abbey	7·10
,,	Scalby, Silverdale	3·27	,,	Crossmolina, Enniscoe ..	5·74
,,	Ingleby Greenhow Vic..	3·50	,,	Collooney, Markree Obs.	4·70
,,	Middleton, Mickleton ...	4·47	XXIII.	Enniskillen, Portora ...	3·60
X.	Beltingham	3·33	,,	Warrenpoint.....	4·04
,,	Bamburgh	2·53	,,	Banbridge, Milltown ...	3·89
,,	Keswick, The Bank	5·74	,,	Belfast, Springfield	3·69
,,	Melmerby Rectory	4·33	,,	Bushmills, Dundarave..	2·14
XI.	Llanfrechfa Grange	4·02	,,	Stewartstown	3·79
,,	Treherbert, Tyn-y-waun	8·89	,,	Killybegs	3·35
,,	Castle Malgwyn	5·86	,,	Horn Head	2·51

METEOROLOGICAL NOTES ON SEPTEMBER, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—On the whole finer than any of the summer months, and there was no persistently wet or cold weather. A TS of considerable severity occurred on the evening of the 4th, lasting for over 3 hours, with T, L and R. There was a little fog in the last week. Mean temp. 58°·4, or 0°·7 above the average.

ABINGER HALL.—A month of sharp contrasts, with a remarkably heavy fall on 4th. All green crops were growing more than in August. Two severe frosts.

TENTERDEN.—There were two hot days to begin with, then showery with TSS on 2nd and 4th, and a violent gale on the night of the 10th. Duration of sunshine 177 hours.

SHEPPEY, LEYSDOWN.—Unsettled and showery. During a TS on 4th ·92 in. of R fell in about an hour. Terrific gale on the night of the 10th.

CROWBOROUGH.—Warm and not unpleasant, with a mean temp. of 56°·3. Gale on 8th and a severe one on 10th. R ·60 in. below the average of 27 years.

EMSWORTH, REDLANDS.—R 1·65 in. in excess of the average of 19 years. TSS on 4th and 2·21 in. of R, the heaviest fall in 24 hours ever recorded here.

HARTLEY WINTNEY.—The first month of the year with R below the average. Mild throughout. A terrific S.W. gale on the night of the 10th, doing damage to trees only. Ozone on 9 days with a mean of 2·2. TS on 4th.

BURY ST. EDMUNDS, WESTLEY.—Very wet for harvest, with ten wet days in succession. Cold in the middle, very mild at the beginning and end. TS on 4th.

TORQUAY, CARY GREEN.—R ·89 in. above the average. Duration of sunshine 155·2 hours, being 9·1 hours below the average. Mean amount of ozone 4·5; max. 7·5 on 20th with S.E. wind, min. 1·5 on 2nd with E.S.E. wind and on 25th with W. wind.

HARTLAND ABBEY.—On 10th there was a very severe storm from S.W., W. and N.W., and all vegetation was very much scorched. The general opinion was that the wind was very strongly charged with salt, as it was seen on the windows on the morning of the 11th. Many trees were blown down.

LYNMOUTH, ROCK HOUSE.—A warm month, excepting a cold spell between 9th and 16th, but there were no extremely hot days. A mock moon was seen at 9.5 p.m. on 6th. Violent S.W. to N.W. gale on 10th.

NORTH CADBURY RECTORY.—Much nearer to normal conditions than any of the summer months. It was rather wet and very damp. The last 11 nights were most abnormally warm. The great gale of the 10th did much damage. Every road was blocked with limbs or trunks of trees. The fury of the gale began about 4 p.m. from S. and was worst from 5 to 6 p.m. and from 10 p.m. to 1 a.m. Hedges and trees were browned on the windward side.

CLIFTON, PEMBROKE ROAD.—Unsettled and rainy till 12th and from 23rd to the end. A dry period intervened with N. and E. winds, cold at first and warm after. The gale of the 10th was one of the most violent ever known here and caused enormous damage to the "sea defences" of the upper part of the Bristol Channel, and the destruction of a great number of trees.

ROSS, THE GRAIG.—Rather more than the average amount of R on about the usual number of days. It was warm on 1st and from 20th to the end, the remainder being very cold for the season. The gale of the 10th was very severe, many trees being blown down.

BOLTON, THE PARK.—Unsettled until 12th, 1·20 in. of R falling on 8th and 1·67 in. on 10th, the total to the 12th being 5·01 in. Floods occurred on the evening of the 10th, but very slight damage was done. This was succeeded by anticyclonic conditions with warm and humid atmosphere till near the close, affording farmers an opportunity of harvesting. Bright sunshine was recorded on 25 days, amounting to 91 hrs. 10 mins.

WALES AND THE ISLANDS.

LLANFRECHFA GRANGE.—Very wet. The harvest was much hindered and damaged by the storm on 10th, during which many trees were blown down.

HAVERFORDWEST.—The first 13 days were wet; on 10th a heavy storm occurred, the bar. falling an inch between 4 a.m. and 6.40 p.m. The force of the wind was tremendous and roofs were stripped and trees snapped off or uprooted. Foliage except evergreens was blasted as if by fire in a way never seen before. Sharp T8 on the night of the 26th. Duration of sunshine 133·7 hours.

ABERYSTWITH, GOGERDDAN.—Another bad month. Much R till 11th, and a fearful storm of wind on 9th and 10th, uprooting trees. From 12th to 23rd was ideal weather with a little frost. The remainder was wet and cold.

DOUGLAS, WOODVILLE.—Only twice (since 1873), in 1883 and 1891, has the R of September exceeded this month's fall of 6·17 in., of which 4·41 in. fell in the first 12 days. From 12th to 21st was fine and dry, with strong, cold N.E. winds; afterwards very mild, with daily R to the end. Violent W.N.W. gale on 9th, and S.E. gale on 21st, when all steamers had to leave Douglas Harbour for shelter elsewhere.

SCOTLAND.

CARGEN [DUMFRIES].—Most unfortunate for harvest operations. A dry spell from 12th to 21st allowed of finishing the work in earlier districts, but the greater part of the oats was still in the fields at the end and suffered much from the wet, "muggy" weather. Frost on 15th did much damage in gardens.

LILLIESLEAF, RIDDELL.—September was very much like its predecessors, but with less wind. It was thus difficult to get in the corn which in the high ground was all out on the last day of the month.

TIGHNABRUAICH.—The R was not excessive and its effect on the cut grain was minimised by the high wind.

BALLACHULISH, ARDSHEAL.—The almost constant R of August continued till September 11th, followed by 10 dry days, which in turn was succeeded by slight daily showers till 29th, when heavy R began again.

STRONVAR.—The most backward September for 31 years. A considerable amount of hay was still out at the end and corn was not all cut. On 7th 1·08 in. of R fell in 8 hours and on 23rd 1·43 in. in 8 hours.

COUPAR ANGUS.—The noteworthy features were—the excess of wet days rather than heavy falls, and the high night temp. of the last 10 days.

ALFORD, LYNTURK MANSE.—Cold and wet to 20th, like the summer since the end of May; afterwards it was dry with slight exceptions, the 7 successive days from 20th to 26th being the longest dry period since the end of May. The night frosts were dangerous for oat crops, which were not yet ripened.

WATTEN.—The first half was wet, dull and cold; the second, mild, dry and fine, with slight frosts, heavy fogs and some T.

IRELAND.

CORK, WELLESLEY TERRACE.—R 1·37 in. above the average. The mean temp. was the lowest in September for 21 years. The storm on 10th was most disastrous and was accompanied by a fall of bar. of ·76 in. in 7 hours.

MILTOWN MALBAY.—Boisterous winds from S.E. to S.W., often approaching the force of a gale, prevailed throughout, with a hurricane on 10th, which lasted with damaging force for a quarter of an hour. All crops were damaged and much hay left uncut.

DUBLIN, FITZWILLIAM SQUARE.—A fitting sequel to the summer months of 1903. A cold spell followed a disastrous storm on 10th, and lasted until the 16th inclusive. Subsequently the temp. recovered under the influence of S. winds and remained high to the end, and the mean temp. (56°) was 0°·1 above the average. A redeeming feature was the amount of bright sunshine, the duration of which was 166 hours, or 44 per cent. of the possible duration.

OMAGH, EDENFEL.—Up to the 12th the weather was no improvement on that of August, but from 13th to 26th a comparatively fine period went some way in redressing the effects of that disastrous month. There was, however, at the end much grain and even hay still in the fields. The temp. of the last fortnight was over 5° above the average.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1903.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	61·1	29	27·8	18	53·6	37·1	46·4	74	108·4	21·2	2·14	13	5·6
Malta	76·2	30	47·4	25	64·2	52·7	49·2	75	126·5	40·9	·98	6	3·8
Lagos, W. Africa	92·0	3	70·0	20	89·3	78·6	76·8	79	142·0	...	7·39	8	...
Cape Town	86·8	4, 5	41·1	24	70·0	53·9	51·4	70	...	...	2·18	6	4·8
Durban, Natal	86·2	19	55·8	29	78·7	62·8	...	...	141·8	...	5·97	18	5·3
Mauritius	84·6	10	62·8	7	81·6	70·4	69·8	83	147·5	54·6	6·18	22	5·9
Calcutta	107·6	29	68·0	6	98·6	75·1	69·4	60	159·0	63·8	1·71	2	1·3
Bombay	93·3	23	68·6	2	88·5	76·1	71·9	72	136·7	59·3	·00	0	1·4
Madras	98·0	1	72·6	16	93·0	76·7	74·0	75	142·8	69·0	·00	0	2·2
Kodaikanal	74·3	22	50·5	8	69·3	53·4	46·8	63	145·8	41·2	4·07	5	4·4
Colombo, Ceylon	93·0	22	72·8	11	90·8	76·3	77·0	84	148·8	72·0	7·62	18	5·1
Hongkong	83·5	22	62·0	4	76·8	68·7	66·7	83	135·7	...	4·73	10	7·7
Melbourne	88·5	10	44·4	16	67·0	51·3	48·5	72	141·8	33·0	3·76	16	7·3
Adelaide	92·9	9	45·8	13	71·3	54·9	50·2	65	142·4	41·8	2·78	14	6·2
Coolgardie	93·8	8	37·8	25	72·6	51·3	47·5	59	156·2	26·3	1·03	3	5·2
Sydney	85·9	5	51·3	27	71·5	58·8	54·0	75	118·3	44·0	1·73	17	5·3
Wellington	70·0	14	40·0	26	61·9	48·8	47·2	75	118·0	30·0	4·51	12	6·5
Auckland	71·5	13	47·0	26	63·6	53·4	50·2	74	135·0	45·0	2·66	15	4·6
Jamaica, Negril Point	90·1	28	66·8	21	85·8	71·2	69·6	72	...	...	·64	4	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	92·4	30	71·2	5	86·5	74·6	68·6	69	150·6	...	·65	7	2·1
Toronto	76·2	29	14·4	5	52·7	35·0	33·1	67	91·2	18·0	3·74	...	5·6
Fredericton, N.B.	73·8	29	12·2	6	51·2	28·8	25·5	52	...	...	2·82	10	6·4
Winnipeg	71·3	26	15·0	29	52·6	27·4	...	...	...	...	·54	8	4·4
Victoria, B.C.	61·3	28	31·2	11	52·7	40·3	...	...	...	...	1·39	14	7·6
Dawson	52·8	30	−18·4	9	36·1	11·8	...	...	...	...	·60	3	3·5

MALTA.—Mean temp. of air 57°·4, or 2°·3 below; mean hourly velocity of wind 12·9 or 1·4 above, averages. Mean temp. of sea 63°·0. TS on 1st.

Mauritius.—Mean temp. of air equal to, dew point 1°·0, and R ·98 in. above averages. Mean hourly velocity of wind 0·2 miles below average; extremes 23·3 on 22nd, and 1·7 on 10th; prevailing direction E.S.E. L on 2 days; L and T on 5 days.

MADRAS.—Bright sunshine 235·5 hours.

KODAIKANAL.—Mean temp. of air 59°·7. Mean velocity of wind 317 miles per day. Bright sunshine 208 hours.

COLOMBO.—Mean temp. of air 83°·2, or 0°·7 above, of dew point 2°·5 above, and R 3·62 in. below, averages. Mean hourly velocity of wind 5·2 miles, prevailing direction S.W. T88 on 13 days, L on 12 other days.

HONGKONG.—Mean temp. of air 72°·4 or 2°·5 above average. Sunshine 87 hours. Mean hourly velocity of wind 13·2 miles; prevailing direction E. by S.

Adelaide.—Mean temp. of air 63°·1, or 0°·9 below average. Splendid rains.

Sydney.—Mean temp. of air 0°·6 above, humidity 3°·4 below, and R 3·74 in. below, averages.

Wellington.—Mean temp. of air 3°·3 above, and R ·98 in. above, averages.

Auckland.—Mean temp. of air 3° below, and R one inch below averages.

SYMONS'S

METEOROLOGICAL MAGAZINE.

No. CCCCLIV.] NOVEMBER, 1903. VOL. XXXVIII.

THE RAINFALL OF OCTOBER, 1903.

THE remarkable abundance of the rainfall of the present year has, we hope, convinced the public that the British Isles are not drying up. Up to last year there was some reason for the suspicion, if only a short series of years was considered. For instance, an observer who commenced to record rainfall in the seventies might find, on examining his records, that each successive period of ten years (though perhaps not each successive period of five years) was drier than the one before. He had no personal knowledge of the fact that dry spells came before the wet spell as well as after it, and so might fail to see the reasonableness of expecting a wet spell to follow. A year that bids fair to compete successfully for the title of unprecedented in wetness has now come upon us, teaching a wholesome lesson to those who were inclined to generalize from short views, though unfortunately causing much damage and distress in many parts of the country.

October is recognised as the wettest month of the year over all parts of our islands except the west and north-west, and heavy rain in October rarely attracts special notice; but the exceptional nature of the month just passed compels rather than induces us in allocating the space of the present number to give up to rainfall what was meant for all meteorology. The Table of Rainfall on p. 184 shows that all the stations for which an average is published were wetter than the average, and in about half the instances quoted the fall was more than double that of a normal October. The Supplementary Table on p. 185 shows at least 22 falls exceeding 10 inches, and only three less than 4 inches.

Coming after so long a succession of wet months, October 1903, has in many, if not in most, parts of the country brought the total rainfall for the year up to the highest figure previously recorded for any complete year. Considering the ten months alone, our table on p. 183 shows that the excess this year over the average of the ten years 1890—99 (which, however, was a somewhat dry decade) amounts to from 17 per cent. at Clifden, in the west of Ireland, to 88 per cent. at Camden Square; the average excess for the whole country is probably very close to 45 per cent., or we may say nearly

RAINFALL, OCTOBER 1903.
English Miles
Shetland I.
Fair I.
Orkney Is.
Butt of Lewis
C. Wrath
St. Kilda
Hebrides
The Minch
Moray Firth
Buchan Ness
Barra Hd.
Skye
Mull
Islay
Firth of Forth
NORTH SEA
ATLANTIC OCEAN
Ireland
Ennis
Ennis Hd.
Galway
Dublin
Holyhead
Liverpool
I. of Man
Scarborough
Flamborough Hd.
Hull
R. Humber
The Wash
IRISH SEA
R. Shannon
Waterford
Cork
C. Clear
St. George's Channel
Bristol Channel
Milford Haven
Portland
I. of Wight
Beachy Hd.
Land's End
Scilly Is.
Start Pt.
English Channel

half as much again as the average. The actual fall for the month was very nearly twice the average amount, when the country is considered as a whole, and it is remarkable that scarcely any stations have recorded less than 4 inches, whereas in a normal October scarcely any stations record more than that amount. The distribution of the rainfall over the surface is so interesting that we have prepared a map from data supplied by about 400 stations, and reproduce it on a scale large enough to make the general features clear. A comparison with the similar map published for June (p. 94) will show that, although June was wetter than October in London, it was really a dry month compared with October.

No part of the British Isles could be called even moderately dry in October, and rain fell nearly every day. Several stations recorded 31 days with rain, a large number had 30, and very few indeed less than 25. Only a few stations on the coast of Kent, Essex, Suffolk and Nairn had less than 4 inches to report; but a considerable area in the middle of Ireland, from the east coast westward to the Shannon, had a lower fall. So far as we can ascertain, Dublin was the only place where less than 3 inches were measured, and there the fall had the unique distinction of being nearly half-an-inch below the average. The greater part of Ireland, the north-east and south-east of Scotland, the east of England and the valley of the Trent had less than six inches; all the rest of the country had more. It is curious to observe how closely the distribution resembles that of an average year; in fact, if the figures attached to each of the lines were multiplied by 5, the map would be a very fair representation of the average distribution of annual rainfall.

The wettest districts, with over 10 inches of rain, were a very small patch in the extreme west of Co. Galway, the Western Highlands, a portion of the Southern Uplands of Scotland, the Lake district (where the gauge at The Stye registered the enormous amount of over 32 inches in the single month), a small portion of the south of the Pennine chain, the whole of inland Wales, the Devon and Cornwall moors, and a narrow strip (mainly in Hampshire) running from Salisbury to Guildford. Over all these areas more than 1000 tons of water fell on every acre of land during the month.

Within the line of 10 inches it has only been possible to indicate on the map two zones of greater rainfall; these are bounded by the lines of 15 and 20 inches. It will be seen that in both South Wales and North Wales a very considerable amount of country was subjected to more than 15 inches in the month, or more than 1400 tons of water per acre.

Enormous damage has been done to crops, and it was pitiable to see corn and even hay standing in the sodden fields in the last week of October, ruined beyond all hope of saving. So wet a month has not been seen before in the present generation, and it is doubtful if so remarkable a series of wet months as this year has brought was ever previously experience in this country.

There are only two previous Octobers in the long annals of British Rainfall which can bear comparison with the month just passed. Of these the more recent was October, 1891, when a very large proportion of the fall of a dry year took place in the one month, but many stations had less than the average amount of rain and a large part of the north of England, Scotland and Ireland received less than 4 inches. That month, although extremely wet, has now been far surpassed. The second case of a very wet October was in 1865, a year of average rainfall, when the one month following an almost rainless September, yielded about 30 per cent. of the yearly total. In 1865 October was considerably wetter than in 1903 in the south of England, but rather drier in the north. On the average the months probably differed little; but in the short time elapsing between the arrival of the monthly returns, which revealed the widespread wetness of last October, and the publication of this Magazine it has been impossible to examine the records for 1865 minutely enough to decide which ought to be placed first in order of the amount of rain. It is, however, certain that, with the possible exception of 1865, October, 1903, has been the wettest since *British Rainfall* was founded in 1860, and a rapid examination of the records back to 1800 has failed to show any other year except 1855 which might claim to be a second exception. It may be that October, 1903, was not the wettest month of the name at individual stations but was yet the wettest for the country as a whole, the wetter months in different places having occurred sporadically in different years.

We give a list of the largest and smallest falls for the month that have been reported to us, and as a supplement we have selected from the great mass of correspondence we have received some representative communications which throw light on the abnormal conditions. We wish to thank very heartily those correspondents whose letters we do not print as well as those whose names appear below, and we would like it to be understood that we are always glad to hear of any phenomenon which strikes an observer as unusual or of special interest. With so much original matter we feel that we may be excused from reprinting or epitomising the records of floods and damage from the daily press, remarkable although these records are. To do justice to the matter we should require the whole space of several numbers.

This article is a mere record of fact; it does not attempt to explain the cause of the conditions which it chronicles, though beyond doubt a cause exists and should be ascertainable. A vast amount of rubbish has been printed on the subject; we advise our readers to pay attention only to the signed utterances of scientific men.

List of the Wettest and Driest Stations in October, 1903, which have been reported up to November 8th.

Div.		inches.
X.	The Stye (gauge B)	32·50
,,	Sprinkling Tarn	27·60
,,	Stye Head Tarn	27·40
,,	Mickleden	26·72
,,	Dungeon Ghyll	25·62
,,	Seathwaite (monthly g.)	25·10
,,	Little Langdale, Fell Foot	23·35
,,	Grasmere, High Close	22·77
,,	Wythburn	22·00
XI.	Rhiwbryfdir	21·45
X.	Grasmere, Pavement End	20·89
,,	Buttermere, Hassness	20·82
,,	Rosthwaite	20·70
XI.	Treherbert, Tyn-y-waun	20·56
VIII.	Skelwith Bridge [Ambleside]	20·22

Sixty-two stations reported falls exceeding 12 inches in the month; the above are all those exceeding 20 inches.

XXI.	Dublin, Fitzwilliam Square	2·61
II.	Minster, Gas Works	3·03
XXI.	Castledermot	3·29
IV.	Burgh Castle Rectory	3·73
XXI.	Athlone, Twyford	3·81
,,	Ballybrack, Streamville	3·85
,,	Carlow, Browne's Hill	3·92
,,	Gorey, Courtown House	3·93
II.	Sheppey, Leysdown	3·96
,,	Ramsgate, West Cliff Villas	3·97
VI.	Great Barrington	4·10
XVII.	Cawdor, Budgate...	4·11

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE rainfall measured here in October came to the exceptional figure of 7·88 inches, and I am interested to know if any of your other correspondents in this district have measured so large an amount. Rain fell on 28 days in the month, and on two days the amounts exceeded an inch, viz., on the 11th of the month 1·62 in., and on the 27th 1·08 in. The rainfall from the beginning of the year up to the end of October is 37·28 in.

MORRIS BIRKBECK.

Dippen Hall Cottage, Farnham, Surrey, Nov. 2nd, 1903.

I SEND you the result of my records for this rainy season. From the 23rd of September to the 31st of October, there was only one day during the period of thirty-nine days on which I did not register rain, and that was Saturday, the 17th of October. In the last eight days of September the total was ·85 in. In thirty days of October the total was 8·17 in., making a total for the period of 9·02 in. My average of 25 years is 3·14 in. for October. So this year's record for October is far more than double, as it exceeds the average by

5·03 in., and it exceeds the heaviest fall which I have registered in October (*i.e.*, 6·83 in. in October, 1891) by 1·34 in. The rainfall for the ten months of the year, at this station, is 30·64 in., whereas my average is 21·54 in. The excess, therefore, for the year up to this date is 9·10 in. T. W. SIDEBOTHAM.

The Bourne Vicarage, Farnham, Surrey, Nov. 2nd, 1903.

I AM sending you my returns of rainfall up to date that you may see that even in a wet year we keep up our reputation for a lower rainfall than other parts of England.

Jan.	Feb.	Mar.	April.	May	June.	July.	Aug.	Sept.	Oct.
2·49	1·47	1·93	2·56	2·25	3·97	3·94	3·09	1·78	4·12

The total for 10 months is 27·60 in. October, usually our finest month, had more rain than any other month.

H. C. V. SNOWDEN.

Hildersham House, St. Peter's, Kent, Nov. 1st, 1903.

I WISH to inform you as to the very abnormal fall of October here. Rain fell on 28 days, and total measured 10·30 in. The total fall for 10 months ending October has reached 40·07 in.

WILLIAM ESDAILE.

Park View, Burley Manor, Ringwood, Nov. 7th, 1903.

As you may like to use this report of excessive rainfall, I send it in advance of my yearly account. The total for October is 10·63 in., falling on 30 days. Every month so far has exceeded the average.

G. NORSWORTHY.

Elderfield, Otterbourne, Winchester, Nov. 1st, 1903.

THE following comparison of rainfall for the 10 months, January—October, of the present year, with previous wet years, at six of our older stations, may be of interest at the present time. The station Nash Mills (now Apsley Mills) is near Hemel Hempstead; Rothamsted is near Harpenden; and Bayfordbury is in the neighbourhood of Hertford, in a very central position.

	1903. 10 mths. in.	Diff. from average, 1840-99. in.	1879. 12 mths. in.	1852. 12 mths. in.
Nash Mills or Apsley Mills	34·46	+12·24	34·23	41·54
Hitchin	33·51	+13·38	29·13	34·11
Royston	30·86	+11·74	29·99	36·08
Rothamsted.....	34·07	+11·12	36·02	...
Berkhamsted	32·93	+ 9·47	34·90	...
Bayfordbury	31·82	+11·46	29·94	...
Average	32·94	+11·57	32·27	(36·08)

It will thus be seen that the fall for the past 10 months has exceeded the fall for the whole of 1879 by about half-an-inch, and is within about 3 inches of the fall of 1852. C. WIGAN HARVEY.

Throcking Rectory, Buntingford.

WITH all these portentous returns of rain in to-day's *Times* it seems absurd for me to write about our pigmy rainfall, now *circa* 34 inches, but the fact of only two days in the month being without a record of rain is unprecedented. In 1896 March had only three days without a record, and that is the only case at all similar since 1849, when our record began. W. LUCAS.

Hitchin, November 3rd, 1903.

THIS is the first morning since the 27th of September that my rain gauge has not contained some measurable rain, 37 days giving a total of 7·23 inches. WILLIAM HALL.

Swerford, Oxford, November 5th, 1903.

I WISH to call attention to the parallel between 1891 and 1903. It is really very close for a great part of the year, and especially for October. The question suggests itself, will there now be a ten days anti-cyclone as there was then? H. A. BOYS.

North Cadbury Rectory, November 2nd, 1903.

[Mr. Boys is something of a prophet. The question he propounded has been answered by the barometer, for the anti-cyclonic condition which was fully established on November 4th, lasted, with one slight break, until the 13th, when we send this sheet to press.—ED. *S.M.M.*]

AS you are aware, I have a rain record of over 30 years. My 30-years' average (1871—1900) is 26·965 in. I have already measured this year, for the ten months, 29·96 in.

During the near 33 years I have eight times measured 5 inches in a month, and three times upwards of 6 inches, including last month, which may be said to have had 31 wet days, for though under ordinary circumstances I should have returned Wednesday 21st as blank, I hesitated whether I should read it ·005 in. and put it down as ·01 in., so I have put it down ·004 in. The following are the eight wettest months.

	in.		in.
1876, December.....	6·48	1881, August	5·20
1878, August	5·09	1892, October.....	5·59
1879, October.....	5·60	1900, February	5·36
1880, July	6·51	1903, October	6·82

July, August and September, 1903, (the three preceding months) had each 19 wet days), January 23, and March 21. October, then, is a record, and this September and October beat any two consecutive months.

1876-7.	in.	1880.	in.	1903.	in.
Dec., 1876...	6·48	Sept....	4·57	Sept....	3·58
Jan., 1877...	3·85	Oct. ...	5·60	Oct. ...	6·82
	10·33		10·17		10·40

Again, the average (30 years) for the six summer months, May to October, is 14·87 in.; the actual this year 21·75 in., or 146 per cent., or 142 per cent. for the 10 months.

I have never known fruit such an utter failure.

ROBT. ELMHIRST.

Farnham Lodge, nr. Knaresborough, 2nd November, 1903.

I ENCLOSE report of our rainfall for October just ended, the total being 8·50 in., falling on 27 days. The average fall for October for 20 years is 3·25 in. The ten months' rainfall of 1903 has been 36·08 in., the 20 years' average being 23·60 in.

There is no record of such a precipitation hereabouts at any previous time. The centres of so many of the depressions have travelled over us lately, that one is not surprised at the result.

G. PAUL,

Harrogate, 1st November, 1903. *Borough Meteorologist.*

THE following may interest you :—Comparison of rainfall in 1903 at Aysgarth Vicarage with that of previous years, beginning with 1876. 1903, total rainfall to October 31st, 48·96 in. Average (1876—1900) for whole year 39·01 in. Wettest year, 1877, 52·03 in. Least rain, 1902, 27·18 in. (1887, 28·97 in.) 1903 rainfall in October, 9·74 in. Wettest October previously, 1892, 8·46 in. (of which, however, more than 5 inches fell in 46 hours). Average for October, 4·07 in.

I hear that at Hawes Junction the rainfall this year, up to date, is about 80 inches, of which, I think, about 35 inches fell in first three months; also, that at Eastgate, Durham, Rev. J. G. B. Knight has measured nearly 12 inches in October. The rainfall at Eastgate is about the same as at Aysgarth generally; it is in Weardale, similar hilly country to this, and about 800 ft. above sea. The wettest months previously were :—1888, November, with 9·44 in.; 1876, December, with 9·28 in.; 1894, February, with 8·74 in.; 1892, October, with 8·46 in.; 1884, January, with 8·27 in.; 1877, November, with 7·86 in.; 1895, July, with 7·74 in. (3 in. fell on 25th); 1903, March, with 7·70 in.

FENWICK W. STOW.

The Vicarage, Aysgarth, Yorks, R.S.O., Nov. 2nd, 1903.

THE rainfall in October has amounted to 8·16 in., which is the largest for any month in my record of 44 years; the previous largest amount being 7·10 in. in November, 1878. The rainfall for the first ten months of this year is 29·21 in., which has been exceeded only in 1900, with a fall of 30·61 in. Two days only during October were quite rainless, ·005 in. having been reached on every day except the 30th. The amount measured on the 8th was 2·59 in., and is the heaviest fall I have recorded in a day in 44 years, with the exception of 26th October, 1900, when the fall was 3·28 in.

T. W. BACKHOUSE.

West Hendon House, Sunderland, November 2nd, 1903.

THE rainfall here in October, viz., 6·88 in., is the largest total recorded here in *any one month* since January 1st, 1868, when observations were begun at this place. The nearest approach that I can find in my registers is 6·76 in. in May, 1886; the next in amount being October, 1872, with 6·65 in.

B. T. GRIFFITH-BOSCAWEN.

Trevalyn Hall, Rossett, S.O., Denbighshire, Nov. 2nd, 1903.

THE rainfall at Dolaucothy, Carmarthenshire, during the month of October, 1903, and throughout the year to date has been as follows :—

	in.	
January...	7·65	five days over half-inch ; heaviest ·95 in.
February	6·13	four days over half-inch : heaviest 1·49 in.
March ...	9·30	twice over 1 inch ; 4 times over half-inch ; heaviest 1·35 in.
April	2·82	once over half-inch, ·82 in.
May	5·50	three times over half-inch ; heaviest ·78 in.
June	1·76	once over half-inch, ·98 in.
July	3·84	twice over half-inch ; heaviest ·85 in.
August ...	8·03	once over 1 inch, 1·90 in. ; 4 times over half-inch.
September	7·46	twice over 1 in. ; 4 times over half-inch ; heaviest 1·80 in.
October ...	16·68	five times over 1 inch ; 7 times over half-inch ; heaviest [1·95 in.
	69·17	

Dolaucothy, 1st Nov., 1903. J. H.-J.

METEOROLOGICAL NEWS AND NOTES.

DR. JULIUS HANN, of Vienna, has been designated by the Council of the Royal Meteorological Society as the recipient of the Symons' Gold Medal, in recognition of the valuable work which he has done in connection with meteorological science. This medal, which is awarded biennially, was founded in memory of the late Mr. G. J. Symons, and the only previous recipient has been Dr. A. Buchan. The medal will be presented at the annual meeting of the society, on January 20th, 1904.

A KITE AS THE MOTIVE POWER for a boat has recently been tested by Colonel S. F. Cody, who crossed from Calais to Dover on Saturday, 7th November, in a small collapsible boat, which was towed by a kite kept flying at the height of about a quarter of a mile. The voyage was made by night, with a favourable wind, and occupied about ten hours. It may be remembered that Benjamin Franklin, as a boy, amused himself when bathing by being drawn across a pond by means of a kite, and from time to time the proposal has been made to use kites instead of sails for ships.

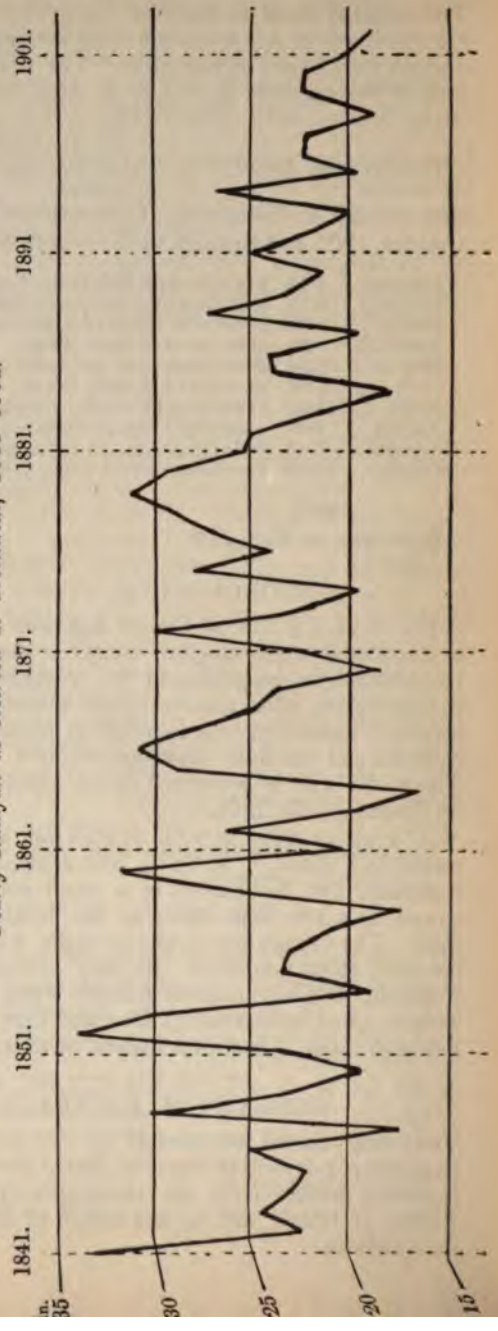
GREENWICH RAINFALL, 1841–1902.

THE long record of rainfall at Greenwich Observatory is so frequently referred to that we have pleasure in reproducing the following article from our contemporary *The Observatory*, to the Editors of which, and to the author of the paper, we express our indebtedness.

GREENWICH RAINFALL, 1841–1902.

The abnormal rainfall of the present year approximating closely in ten months to the heaviest annual fall on record, has caused so much attention to be directed to the rainfalls in previous years that it has been considered desirable to print a complete table of the falls at Greenwich, and to exhibit the annual fluctuations graphically. It might have been expected that this curve would serve to indicate the coincidence which is alleged to exist between the well-established period of sunspots and the rainfall, but this does not appear to be borne out. The revised table of Wolf's sunspot numbers has already been printed in this journal (*Observatory*, vol. xxv. p. 397), and will need only to be referred to. The sunspot epochs derived from this table are:-

Maximum.
1848, 1860, 1870, 1883, 1893.
Minimum.
1843, 1856, 1867, 1878, 1889, 1901.



Yearly Rainfall as observed at Greenwich, 1841–1902.

The rainfall aggregates for three years at these periods are :--

Sun-spot Maximum.	in.		in.	Sun-spot Minimum.	in.		in.
1847–1849	71·29	Mean	23·76	1842–1844	70·24	Mean	23·41
1859–1861	78·18	,,	26·06	1855–1857	68·02	,,	22·67
1869–1871	64·87	,,	21·62	1866–1868	84·33	,,	28·11
1882–1884	65·14	,,	21·71	1877–1879	87·62	,,	29·21
1892–1894	69·32	,,	23·11	1888–1890	72·65	,,	24·22
				1900–1902	61·94	,,	20·65
Mean			23·25	Mean			24.71

Showing a slight excess at the minimum sun-spot period.

Dr. Meldrum (Proc. Meteorological Society of Mauritius, February, 1873) considered, from the discussion of the results of observations at a number of stations, that the rainfall on the whole was greater at the maximum sun-spot periods that at the minimum periods, but many results in Dr. Meldrum's paper were found to be contradictory.

Table of Annual Rainfall at Greenwich, 1841–1902.

	in.		in.		in.		in.
1841	33·26	1857	21·16	1873	23·36	1888	27·51
1842	22·57	1858	17·70	1874	19·95	1889	23·28
1843	24·47	1859	25·83	1875	27·97	1890	21·86
1844	23·20	1860	31·90	1876	24·10	1891	25·04
1845	22·34	1861	20·45	1877	27·28	1892	22·31
1846	25·29	1862	26·32	1878	28·98	1893	20·12
1847	17·6i	1863	19·66	1879	31·36	1894	26·89
1848	30·10	1864	16·38	1880	29·68	1895	19·73
1849	23·58	1865	28·70	1881	25·72	1896	22·42
1850	19·53	1866	30·72	1882	25·18	1897	22·13
1851	23·53	1867	28·46	1883	21·91	1898	18·85
1852	34·01	1868	25·15	1884	18·05	1899	22·33
1853	29·99	1869	24·02	1885	24·00	1900	22·31
1854	19·01	1870	18·55	1886	24·21	1901	20·29
1855	23·59	1871	22·30	1887	19·86	1902	19·34
1856	23·27	1872	30·02				

The average for the 60 years 1841–1900 = 24·15 inches.

W.C.N.

THE UNEXAMPLED LONDON RAINFALL OF 1903.

THE following letter appeared in *The Times* of October 29th. It may be remarked that the total rainfall for the month at Camden Square was 6·03 in., falling on 26 days; making the total from January 1st to October 31st, 34·94 in.

To the Editor of The Times.

SIR,—You will, I hope, permit me to follow the custom of my predecessors in laying before your readers the facts concerning an interesting point in the history of British rainfall records. This is the certainty, now established, that 1903 is to prove the wettest year since Mr. Symons established his first rain gauge *in Camden Town in 1858*. During the period of 46 years there

were six complete years in which the rainfall exceeded 30 in., and of these the wettest was 1878, with 34·08 in. The rainfall for the portion of 1903, from January 1 to October 27, amounts to 34·61 in., so that, to use a phrase which seems to carry much significance to the general mind, the record is broken.

Table I. shows concisely the relation which each of the six wet years bears to the average, and also to the driest year of the series, 1864. The first column gives the total fall for the first ten months, the second that for the last two months, the third the total for the year, and the fourth the ratio which the total for the year bears to the average expressed as 100.

TABLE I.

Comparison of Wet Years at Camden Square.

	Ten months, January—October.	Two months, November—December.	Year.	Year, per cent. of Average.
Average 1858-1902.....	20·59	4·40	24·99	100
Driest year, 1864	14·08	2·85	16·93	68
Wet year, 1860	27·01	5·23	32·24	129
Wet year, 1866	27·24	4·36	31·60	126
Wet year, 1872	25·53	8·33	33·86	135
Wet year, 1878	29·67	4·41	34·08	136
Wet year, 1879	32·23	1·59	33·82	135
Wet year, 1880	25·26	5·02	30·28	121
Wettest year, 1903* ...	34·61	?	?	?

* To October 27th.

It is interesting to notice that the three years 1872, 1878, and 1879, were almost equally wet, that the total fall was about one-third more than the average, and almost exactly double the fall of the driest year. It will be observed, further, that, while in 1872 the rainfall of the last two months was twice the average, in 1866 and 1878 it was as close to the average as possible, and in 1879 it was only one-third of the average; less, in fact, than in the driest year on record. The moral of this is a warning to prophets. It is impossible to predict what the rainfall of the next two months may be; it may raise the yearly total to little over 36 in., it may cause it to surpass 40, but in either case it will be unprecedented so far as Camden Square is concerned, and for the first time London will have had more than a yard of rain.

Table II. accentuates the variability of the distribution of rain throughout the months, and brings out the fact that in 1903 three months have already had a rainfall exceeding 5 in. each—no earlier year has had more than two.

TABLE II.

Monthly Rainfall of the Wettest Years at Camden Square, compared with the Average.

	Jan.	Feb.	March.	April.	May.	June.	July.
Average.....	1·96	1·64	1·67	1·63	1·88	2·19	2·36
1878	1·31	1·49	1·12	4·97	3·89	6·71	·64
1879	2·87	3·77	·91	2·72	3·46	4·76	4·17
1903	2·15	·83	2·30	2·14	2·99	6·43	5·20

	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Average	2·35	2·27	2·64	2·27	2·13	24·99
1878	6·72	·82	1·99	2·95	1·47	34·08
1879	5·11	3·67	·79	·73	·86	33·82
1903 to October 27th	4·24	2·64	5·69	?	?	?

It may be mentioned that on no previous occasion have more than five days each with over one inch of rain occurred in any one year; but 1903 has already had seven such days. The greatest number of rainy days in October hitherto has been 23; that number has already been surpassed this year.

So far I have confined myself solely to Camden Square and its record since 1858; but I must now venture into the less certain fields of London and all time. There is little doubt that for the British Isles as a whole the wettest year of the 19th century was 1872, and that 1852 followed hard after it, and I think that 1903 will be found at the close of the year to have outstripped both. It so happened that 1878 and 1879 were wetter than 1872 in London, but that is a local incident and not of capital importance.

The rainfall of London before 1840 is largely a matter of speculation, but fragmentary records exist as far back as 1729, and these are capable of furnishing some information. A careful search through them fails to provide proof of any year before 1820 having a rainfall approaching 34 inches. The records exceeding that figure for parts of London within 300 feet of sea level are given in Table III. so far as I can ascertain them. If any other cases exist within the limits stated, I should be glad to be informed.

TABLE III.

Annual Rainfall in London exceeding 34 *in.*

Year.	Place.	Amount.
1821	Greenwich Observatory	34·5*
1824	Greenwich Observatory	36·3*
1852	Greenwich Observatory	34·01
1852	St. John's Wood	35·10
1860	St. John's Wood	34·60
1872	Dorset Square	35·11*
1878	Camden Square	34·08
1878	Stoke Newington	35·06
1879	St. John's Wood	34·13
1879	Regent's Park	34·29

* Doubtful records.

Even including doubtful records we may say that so much as 36½ inches of rain in one year has never been measured in London. If satisfactory records only are considered, the highest fall at any station was 35·10 in. at St. John's Wood in 1852.

In conclusion, I may be allowed to point out that this is the season for planting rain-gauges, so that new observers may have time to become accustomed to their work before commencing a new year. And I may also say that it is eminently desirable that trustworthy rain gauges should be set up in open spaces in London, by public authorities, as a safeguard against the records being broken, in the unfortunate sense of that term, by the mortality of solitary enthusiasts.

I am, your obedient servant,

HUGH ROBERT MILL.

62, Camden Square, N. W., October 28th.

ON THE RATE OF FALL OF RAIN AT SEATHWAITE.

By HUGH ROBERT MILL, D.Sc., LL.D.

Abstract of paper read at the British Association, Southport Meeting.

A recording rain gauge on Negretti and Zambra's pattern was established at Seathwaite in Cumberland in the wettest part of the Lake District in July, 1899, by the late Mr. Symons, and records were obtained up to the end of December, 1900. Ordinary observations of rainfall are available for many years at the same place, and as the result of 38 years (1865-1902) the average rate of fall is ·614 inch per rainy day, a rainy day being one on which more than ·005 in. falls, and on the result there are 216 such days in the year, the total mean annual rainfall being 132·53 in. The total number of rainfall days for the eighteen months (July, 1899—December, 1900) was 350; the total rainfall by the recording gauge 182·91 in., or at the rate of ·523 in. per rainy day. The average duration of rainfall was 4¾ hours per rainy day, or nearly double the duration in London. During the period in question rain fell during 1695 hours, or at an average rate, when raining, of ·108 in. per hour.

Taking account of continuous falls of 6 hours' duration or longer, there were 91 occasions with a total length of 822 hours, a total fall of 99·99 in., and an average rate of ·122 in. per hour.

Taking account of falls exceeding ·50 in. in amount, there were 86 occasions with a total duration of 703½ hours, a total fall of 109·47 in., and an average rate of ·156 in. per hour.

The maximum rate at which half-an-inch or more rain fell during the eighteen months in question was ·56 in. per hour, a total of 1·40 in. falling in 2½ hours from 8 to 10.30 p.m. on September 21st, 1899. This is a trifling rate compared with the fall of from 2 to 3 inches in an hour which may occur in a thunderstorm in any of the drier parts of the country, and even if attention is confined to falls of one hour only, no instance occurred of a rate equal to ·75 in. per hour. The peculiarity of the Seathwaite rainfall seems to be its long duration and comparatively small rate of fall. The longest and heaviest shower in the period considered was 19¼ hours, during which 3·59 in. of rain fell, at an average rate of ·186 in. per hour.

The duration of rainfall during daylight (sunrise to sunset) and during darkness (sunset to sunrise) was calculated for the year 1900, with the result :—

	No. of hours Rain.	Amount of Rain. in.	Rate. in. per hour.	No. of Days.
Daylight	595 ...	61·28 ...	·103 ...	197
Darkness	596½ ...	64·66 ...	·108 ...	172

This shows that the duration of rainfall in daylight and darkness was practically identical, but that there was a very slightly greater intensity in the night than during the day.

It is very desirable to extend the use of recording rain gauges, and to be of much value the scale should be open enough to give exact readings, preferably giving a separate record strip for each day.

BOOKS RECEIVED.

Isforholdene i de Arktiske Have, 1902. [The state of the ice in the Arctic Seas, 1902.] Published by the Danish Met. Inst. Size 12 × 9½. Pp. 22 and six plates.

Annual Report of the Director of the Royal Alfred Observatory, Mauritius, for 1901. By T. F. Claxton. Size 13¼ × 8½. Pp. 24.

THE TEN MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—October, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	16·32	188	Arncliffe ...+	24·47	150	Braemar ...+	11·28	141
Tenterden	+6·75	131	Hull	+6·29	130	Aberdeen	+8·40	133
Hartl'yW'ntn'y+	14·12	169	Newcastle.....	+9·47	145	Cawdor	+4·89	120
Hitchin .....+	14·62	177	Seathwaite +	38·64	137	Glencarron +	18·73	125
Winslow .....+	12·70	166	Cardiff .....+	16·17	151	Dunrobin	+6·77	128
Westley.....	+7·39	136	Haverf'dwest+	14·88	144	Darrynane ...	+7·93	120
Brundall.....	+5·84	129	Gogerddan +	16·80	148	Waterford +	10·74	134
Alderbury .....+	13·33	161	Llandudno ...+	7·59	131	Broadford..+	12·08	145
Ashburton .....+	18·32	148	Dumfries ...+	18·86	154	Carlow .....+	11·70	143
Polapit Tamar +	14·89	151	Lilliesleaf ...+	14·15	158	Dublin	+5·48	124
Stroud .....+	14·74	167	Colmonell	+8·81	126	Mullingar...+	13·54	146
Woolstaston ...+	14·56	162	Glasgow ...+	21·35	175	Ballinasloe +	11·75	140
Boston .....+	10·19	161	Inveraray ...+	19·04	134	Clifden .. ...+	11·07	117
Hesley Hall	+7·14	141	Islay .....+	11·86	133	Crossmolina +	14·54	136
Derby.....	+9·13	148	Mull .....+	14·12	132	Seaforde ...+	13·01	145
Bolton .....+	10·44	131	Loch Leven +	18·76	166	Londonderry..+	6·87	121
Wetherby .....+	14·67	174	Dundee	+9·37	143	Omagh .....+	15·57	149

REVIEW.

Les Variations Passagères de la Température, causes ou effets des tourbillons atmosphériques. P. MARC DECHEVRENS, S.J. Estratto dalle Memorie della Pontificia Accademia Romana dei Nuovi Lincei, vol. XIX. (1902).

WE are pleased to call the attention of readers interested in the theory of cyclones, to the above publication. The author concludes from observations made at Pike's Peak, Colorado, and various other high level stations, that, at an altitude of about 4000 metres, the temperature of the air in a cyclonic disturbance is much below the average, just as it is much above at sea level. He then proceeds to show that cyclones, at all events those of Europe, cannot be satisfactorily explained by the convection theory, which ascribes their origin to the ascent of masses of heated air, maintaining, on the contrary, that the abnormal development of heat in the lower atmosphere of a disturbance, as well as of cold in the elevated regions, is the product and not the cause of cyclone action, the excess of temperature below being due to a concentration of the particles of air and the deficit above to a radial dispersion or rarefaction of them. Father Dechevrens' pamphlet contains an impartial exposition of facts together with the results of original investigation.

RAINFALL AND TEMPERATURE, OCTOBER, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date	Days on which 0·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. Nights below 32° In shade.
			inches.	inches.	in.							
I.	ENGLAND.	London (Camden Square) ...	6·03	+ 3·44	·94	11	26	67·4	1	36·0	24	0
II.		Tenterden ...	4·76	+ 1·77	·62	11	26	66·4	3	35·0	31	0
„		Hartley Wintney ...	7·49	+ 4·60	1·24	11	31	65·0	1*b*	33·0	24*d*	0
III.		Hitchin ...	5·73	+ 3·16	·90	11	29	65·0	1	37·0	23*e*	0
„		Winslow (Addington) ...	6·30	+ 3·61	·83	27	27	66·0	3	33·0	21	0
IV.		Bury St. Edmunds (Westley)	5·30	+ 2·64	·83	11	25	68·0	3	35·0	10*f*	0
„		Norwich (Brundall) ...	4·21	+ 1·59	·74	11	27	67·0	3	35·4	24	0
V.		Winterborne Steepleton ...	8·32	...	·87	19	30	65·3	1	31·2	31	1
„		Torquay ...	6·95	...	·69	14	28	63·8	3	40·9	29	0
„		Polapit Tamar [Launceston]..	11·27	+ 6·73	1·30	27	30	65·4	2	35·1	29	0
VI.		Stroud (Upfield) ...	7·09	+ 4·31	1·15	11	29	65·0	1	33·0	30	0
„		Church Stretton (Woolstaston)	6·78	+ 3·28	1·10	27	31	62·0	1	37·5	24	0
„		Worcester (Diglis Lock) ...	5·16	+ 2·51	·80	11	28	...	...	...	...	...
VII.		Boston ...	5·63	+ 3·36	·95	11	21	65·0	1	35·0	24	0
„		Hesley Hall [Tickhill]...	5·22	+ 2·65	·60	14	23	66·0	1	35·0	24	0
„		Derby (Midland Railway)...	5·38	+ 2·84	·76	6	30	66·0	1	34·0	9	0
VIII.		Bolton (The Park)...	9·72	+ 5·16	1·35	27	30	60·0	6	36·5	10	0
IX.		Wetherby (Ribston Hall) ...	8·61	+ 5·81	1·55	8	29	...	...	...	...	...
„		Arncliffe Vicarage...	14·77	+ 8·13	1·33	8	30	...	...	...	...	...
„		Hull (Pearson Park).	5·84	+ 2·80	·72	11	26	66·0	1	30·0	24	3
X.		Newcastle (Town Moor) ...	9·24	+ 6·52	3·68	8	29	...	...	...	...	...
„		Borrowdale (Seathwaite)...	23·64	+10·22	2·35	26	30	63·5	5	31·8	10	1
XI.	WALES.	Cardiff (Ely)...	11·37	+ 6·94	2·19	14	29	...	...	...	...	...
„		Haverfordwest	10·17	+ 5·09	1·02	14	29	61·6	4, 7	35·2	28	0
„		Aberystwith (Gogerddan) ...	12·08	+ 6·52	1·21	19*a*	29	64·0	11	32·0	23	1
„		Llandudno...	5·43	+ 1·43	·92	27	29	62·0	6	40·5	27	0
XII.	SCOTLAND.	Cargen [Dumfries]	10·40	+ 5·97	1·36	27	29	62·0	1	28·0	10	1
XIII.		Edinburgh (Royal Observatory)	5·72	...	1·06	8	30	62·1	1	35·6	10	0
XIV.		Colmonell	9·01	+ 4·67	·85	6	28	65·0	24	32·0	9	1
XV.		Tighnabruaich	10·61	...	·88	4	29	57·0	3	34·0	9	0
„		Mull (Quinish)...	11·51	+ 5·94	1·16	4	27	...	...	...	...	...
XVI.		Loch Leven Sluices ...	7·55	+ 3·88	·97	7	29	...	...	...	...	...
„		Dundee (Eastern Necropolis)	5·30	+ 2·54	·70	6	27	62·6	2	32·6	24	0
XVII.		Braemar	5·39	+ 1·51	·82	27	29	57·0	1	29·2	10	1
„		Aberdeen (Cranford)	4·86	+ 1·50	·71	27	26	63·0	2	33·0	23	0
„		Cawdor (Budgate) ...	4·11	+ 1·17	·63	3	29	...	...	...	...	...
XVIII		Strathconan [Beauly] ...	9·96	+ 4·31	2·49	16	17	...	...	...	...	...
„		Glencarron Lodge...	13·43	+ 4·14	2·61	15	29	61·0	1	29·2	10	2
XIX.		Dunrobin ...	4·63	+ 1·35	·65	24	22	64·0	2	33·0	7*f*	0
„		Castletown...	6·18	...	1·07	5	30	60·0	1	27·0	8	2
XX.	IRELAND.	Darrynane Abbey...	8·31	+ 3·10	1·00	10	29	...	...	...	...	...
„		Waterford (Brook Lodge) ...	6·56	+ 2·66	1·36	28	26	61·0	1, 3	26·0	28	2
„		Broadford (Hurdlestown) ...	5·73	+ 2·63	1·03	28	28	62·0	1	28·0	27	3
XXI.		Carlow (Browne's Hill) ...	3·92	+ ·52	·46	27	27	...	...	...	...	...
„		Dublin (Fitz William Square)	2·61	— ·42	·32	6	22	64·9	6	33·6	28	0
XXII.		Ballinasloe	4·59	+ 1·19	·62	28	30	66·0	6	22·0	28	4
„		Clifden (Kylemore)	11·25	+ 3·31	50	28	29	...	...	...	...	...
XXIII		Seaforde...	7·43	+ 3·84	1·31	25	28	60·0	2*c*	32·0	26	1
„		Londonderry (Creggan Res.).	6·82	+ 2·74	·93	6	31	...	...	...	...	...
„		Omagh (Edenfel) ...	7·28	+ 3·37	1·09	6	29	60·0	1, 4	32·0	26*a*	2

+ Shows that the fall was above the average ; — that it was below it.
a and 27. b and 2, 3. c and 3, 4. d and 31. e and 30. f and 24.

SUPPLEMENTARY RAINFALL, OCTOBER, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Harrow Weald	7·30	XI.	Llandefaelog-fach.....	10·29
II.	Dorking, Abinger Hall .	8·93	,,	New Radnor, Ednol.....	10·50
,,	Sheppey, Leysdown	3·96	,,	Rhayader, Nantgwillt...	15·06
,,	Hailsham	7·01	,,	Lake Vyrnwy	13·59
,,	Crowborough.....	9·28	,,	Ruthin, Plâs Drâw	7·86
,,	Ryde, Beldornie Tower..	6·57	,,	Criccieth, Talarvor	8·71
,,	Bournemouth, Kempsey	9·38	,,	I. of Anglesey, Lligwy..	7·45
,,	Emsworth, Redlands ...	8·78	,,	Douglas, Woodville.....	8·95
,,	Alton, Ashdell	10·07	XII.	Stoneykirk, Ardwell Ho.	9·46
,,	Newbury, Welford Park	8·35	,,	Dalry, Old Garroch	12·34
III.	Oxford, Magdalen Coll..	6·30	,,	Moniaive, Maxwelton Ho.	11·63
,,	Banbury, Bloxham	6·21	,,	Lilliesleaf, Riddell	8·21
,,	Pitsford, Sedgebrook ...	6·22	XIII.	N. Esk Res. [Penicuick]	7·90
,,	Huntingdon, Brampton.	5·35	XIV.	Dalry, Blair	9·30
,,	Wisbech, Bank House...	4·87	,,	Glasgow, Queen's Park..	7·47
IV.	Southend	4·55	XV.	Inveraray, Newtown ...	13·08
,,	Colchester, Lexden	5·01	,,	Ballachulish, Ardsheal...	15·68
,,	Saffron Waldon, Newport	4·95	,,	Campbeltown, Redknowe	11·27
,,	Rendlesham Hall	4·18	,,	Islay, Eallabus..... ...	9·59
,,	Swaffham	6·19	XVI.	Dollar.....	8·64
V.	Salisbury, Alderbury ...	8·97	,,	Balquhidder, Stronvar...	15·58
,,	Bishop's Cannings	6·97	,,	Coupar Angus Station...	4·81
,,	Ashburton, Druid House	12·98	,,	Blair Atholl	6·45
,,	Okehampton, Oaklands.	10·17	,,	Montrose, Sunnyside ...	4·79
,,	Hartland Abbey	11·43	XVII.	Alford, Lynturk Manse..	5·59
,,	Lynmouth, Rock House	12·75	,,	Keith H.R.S.....	4·98
,,	Probus, Lamellyn	9·42	XVIII.	Fearn, Lower Pitkerrie..	5·00
,,	Wellington, The Avenue	6·69	,,	S. Uist, Askernish	8·77
,,	North Cadbury Rectory	6·40	,,	Invergarry.....	10·29
VI.	Clifton, Pembroke Road	8·03	,,	Aviemore, Alvie Manse.	4·38
,,	Ross, The Graig	7·40	,,	Loch Ness, Drumnadrochit	5·72
,,	Shifnal, Hatton Grange	5·40	XIX.	Invershin	5·76
,,	Wem Rectory	5·76	,,	Bettyhill	4·96
,,	Cheadle, The Heath Ho.	5·79	,,	Watten H.R.S.....	4·72
,,	Coventry, Kingswood ...	6·58	XX.	Cork, Wellesley Terrace	5·82
VII.	Market Overton	6·37	,,	Killarney, District Asyl.	8·59
,,	Grantham, Stainby	6·06	,,	Glenam [Clonmel]	5·32
,,	Horncastle, Bucknall ...	5·59	,,	Ballingarry, Hazelfort...	4·27
,,	Worksop, Hodsock Priory	4·88	,,	Miltown Malbay	7·30
VIII.	Neston, Hinderton	7·30	XXI.	Gorey, Courtown House	3·93
,,	Southport, Hesketh Park	6·98	,,	Moynalty, Westland ...	4·34
,,	Chatburn, Middlewood.	...	,,	Athlone, Twyford	3·81
,,	Duddon Val., Seathwaite Vic.	15·76	,,	Mullingar, Belvedere ...	4·67
IX.	Langsett Moor, Up. Midhope	10·43	XXII.	Woodlawn	5·61
,,	Baldersby	7·17	,,	Westport, Murrisk Abbey	9·19
,,	Scalby, Silverdale	7·61	,,	Crossmolina, Enniscoe ..	8·13
,,	Ingleby Greenhow Vic..	8·23	,,	Collooney, Markree Obs.	6·81
,,	Middleton, Mickleton ...	9·54	XXIII.	Enniskillen, Portora ...	6·10
X.	Beltingham	9·23	,,	Warrenpoint.....	4·56
,,	Bamburgh	6·64	,,	Banbridge, Milltown ...	4·63
,,	Keswick, The Bank.....	11·90	,,	Belfast, Springfield	7·30
,,	Melmerby Rectory	8·85	,,	Bushmills, Dundarave..	7·13
XI.	Llanfrechfa Grange	11·43	,,	Stewartstown	5·53
,,	Treherbert, Tyn-y-waun	20·37	,,	Killybegs	7·44
,,	Castle *Malgwyn*	*10·78*	,,	Horn Head	7·83

WALES AND THE ISLANDS.

HAVERFORDWEST.—The greatest R in October during 55 years. Great quantities of R fell in short periods, including 1·02 in. on 15th. It was mild from beginning to end.

BRECON.—TS on evening of 25th.

ABERYSTWITH, GOGERDDAN.—R a record for the month and more than any of the inhabitants can remember, but little damage was done.

DOUGLAS, WOODVILLE.—The R exceeded that of any previous October and, with two exceptions, that of any month in at least 30 years. Gales of unusual violence blew on 13 days. TS on 25th March. R and the worst of the gales occurred at night and there were at least 15 days fine.

SCOTLAND.

CARGEN [DUMFRIES].—The R has only twice been exceeded in a single month since observations were commenced in 1860. In December, 1897, 11·24 in. were registered, and in October, 1874, 10·72 in. Neither of these months, however, had nearly so many rainy days. No harvest work was possible and most of the grain crop was absolutely valueless.

LILLIESLEAF, RIDDELL.—In 39 years record no month has equalled this, the highest previous fall being 7·72 in. in July, 1877, and the highest in October 5·85 in. in 1896. In the whole month there were only four fine days, and it was practically impossible to get any corn in dry. For mild and warm weather the month has probably never been equalled.

BALLACHULISH, ARDSHEAL.—R 9·34 in. above the average. The second wettest month during 11 years.

MULL, QUINISH.—The R of the month has only twice been exceeded—12·49 in. on 30 days in Nov., 1877, and 11·57 in. on 26 days in Sept., 1879.

COUPAR ANGUS.—The most persistent R in a quarter of a century, not so much for total fall as for number of wet days and continually saturated atmosphere. In many cases the harvest was unfinished, the sheaves being half covered with water, so that farmers despaired of saving more. The most disastrous harvest on record. Mean temp. 46°·3.

BLAIR ATHOLL.—Very late harvest. Fully two-thirds of the crop of oats was still in stooks at the end of the month and in a bad condition.

DRUMNADROCHIT.—R 2·26 in. above the average of 17 years. The fall from January 1st exceeds that of any previous whole year for 17 years.

CASTLETOWN, THE CLETT.—Cold and damp, with overcast skies and abnormal R. Harvesting operations were carried on under most disheartening conditions and at the end of the month great parts of the crop were still uncut, and where cut the corn remains wet in the fields.

IRELAND.

CORK, WELLESLEY TERRACE.—Remarkable for excessive R and low temp., the R being 2·52 in. in excess of the average, and for the 10 months 16·77 in. over the average. The mean temp. was 3°·3 in. below the average, and that of 28th the lowest in October for 21 years.

MILTOWN MALBAY.—R every day but one. Mild throughout and vegetation on dry rich lands was vigorous. Owing to the unceasing R, gales and high winds, it is proving a most disastrous year for agriculturists.

DUBLIN, FITZWILLIAM SQUARE.—Frequent but not very heavy R; comparatively high temp.; S.W., W. and N.W. winds; and a high percentage of sunshine. Mean temp. 51°·4, or 2°·0 above the average. High winds on 14 days, reaching the force of a gale on 5. Duration of sunshine 132·75 hours.

COLLOONEY, MARKREE OBSERVATORY.—Very wet and stormy, reaching the force of a gale at times. H showers on 13th, 15th and 17th, and frost on 27th and 28th. The nights were generally cloudy.

BANBRIDGE, MILTOWN.—The R of the last 10 months was 33·97 in., the greatest for 42 years except 1872, which was 36·8 in.

OMAGH, EDENFEL.—The third month this year with R over 7 inches, bringing the total to 47·56 in., over 10 inches above the average for the whole year. A great deal of the grain and late hay was either entirely lost or hopelessly damaged. The *only set off was the* abnormal mildness, which kept the trees *in leaf to the end, accompanied by* a magnificent display of autumn tints.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1903.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	80·9	30	34·9	13	65·1	45·8	47·6	81	122·8	30·1	2·99	17	5·2
Malta	81·2	21	50·2	18	73·4	58·7	56·5	76	132·7	42·9	·00	0	3·5
Lagos, W. Africa	90·0	*a*	73·0	21	88·7	78·2	76·4	77	140·0	...	3·00	7	...
Cape Town	78·8	4	42·8	21	63·4	50·8	50·8	80	...	...	5·16	14	6·0
Durban, Natal	86·7	24	51·3	31	78·4	58·6	...	...	139·1	...	·91	6	3·2
Mauritius	81·8	2 *b*	58·5	13	80·1	65·7	72·2	76	145·2	49·4	1·00	11	4·5
Calcutta	106·2	22*c*	73·2	9	98·6	78·8	73·5	64	164·0	71·0	1·53	3	3·8
Bombay	93·7	22	74·0	26	89·5	79·1	75·8	77	136·8	71·8	7·79	6	3·7
Madras	101·1	16	74·8	19	94·5	78·9	75·6	77	146·0	73·4	5·32	4	4·0
Kodaikanal	71·0	5, 7	49·4	20	67·3	54·3	52·7	79	143·6	42·7	6·00	11	5·8
Colombo, Ceylon	92·2	5	69·6	18	88·5	76·7	76·6	90	146·2	69·1	20·76	25	7·1
Hongkong	87·0	20	66·3	2	79·5	72·2	71·2	87	139·1	...	13·96	16	8·5
Melbourne	71·2	6	33·4	28	58·9	45·6	46·2	83	129·1	24·2	1·94	12	7·1
Adelaide	76·6	7	38·7	31	64·4	47·7	45·9	71	133·5	33·1	1·70	11	...
Coolgardie	76·6	15	34·8	30	64·5	46·7	45·2	70	139·6	29·3	1·91	7	5·6
Sydney	73·0	8	44·7	29	63·9	52·6	48·4	78	103·8	36·0	3·23	24	5·6
Wellington	65·5	3	36·5	24	56·4	46·3	44·9	80	108·0	28·0	8·95	19	6·7
Auckland	64·5	14	44·0	23	60·5	51·5	48·8	77	122·0	42·0	6·09	20	5·1
Jamaica, Negril Point	89·4	21	68·2	4	86·6	73·8	71·5	73	...	...	4·40	12	...
Trinidad	93·0	*a*	61·0	24*e*	93·3	68·6	71·4	71	167·0	61·0	·95	7	...
Grenada	90·2	1	73·0	22	86·6	75·6	69·5	70	149·2	...	1·42	15	3·4
Toronto	83·2	19*d*	28·6	1	66·6	45·2	45·3	67	104·0	25·0	1·80	8	4·1
St. John's, N.B.	72·0	18	28·3	2	55·9	41·9	...	...	...	...	3·13	6	4·4
Winnipeg	84·1	15	17·0	2	67·8	40·6	...	...	...	...	3·40	9	5·0
Victoria, B.C.	64·6	11	38·6	21	57·9	45·3	...	...	...	...	·79	12	6·2
Dawson	65·5	19	18·4	5	53·9	33·0	...	...	...	...	·39	2	3·5
Trinidad March..	93·0	29	61·0	26	89·9	66·6	64·9	65	162·0	60·0	1·74	...	...
Trinidad April ...	94·0	28,29	61·0	29	91·3	65·5	71·0	75	170·0	75·0	2·17	6	...

a several. *b* and 3, 5, 10. *c* and 24. *d* and 20. *e* and 25, 26, 29.

MALTA.—Mean temp. of air 64°·5 or 0°·5 above, mean hourly velocity of wind 11·1 or 1·0 above, averages. Mean temp. of sea 65°·7.

Mauritius.—Mean temp. of air 0°·1 above, dew point 0°·9, and R 3·02 in., below, averages. Mean hourly velocity of wind 9·2 miles, or 1·0 below average.

MADRAS.—Bright sunshine 156·7 hours, or 39·9 per cent. of possible.

KODAIKANAL.—Mean temp. of air 59°·5. Mean velocity of wind 282 miles per day. Bright sunshine 174·6 hours.

COLOMBO.—Mean temp. of air 80°·4 or 2°·1 below, of dew point 1°·4 above, and R 8·90 in. above, averages. Mean hourly velocity of wind 5·5 miles, prevailing direction S.W.

HONGKONG.—Mean temp. of air 75°·4. R 1·42 in. above average. Bright sunshine 82·5 hours, or 70 hours below average. Mean hourly velocity of wind 13·8 miles.

Adelaide.—Mean temp. of air 56°·0 or 1°·6 below, R 1·06 in. below, 46 years' average.

Wellington.—Mean temp. of air 0°·6 below, and R 4·06 in. above, averages.

TRINIDAD.—*R 2·98 in. below* the 40 years' average.

SYMONS'S

METEOROLOGICAL MAGAZINE.

No. CCCCLV.] DECEMBER, 1903. VOL. XXXVIII.

THE GOVERNMENT AND METEOROLOGY.

IT is exactly a year since the appointment of a Treasury Committee "to inquire and report as to the administration by the Meteorological Council of the existing Parliamentary grant," and rumours have recently been heard to the effect that the Committee had agreed upon a report recommending certain changes. It is somewhat disappointing to find that this is not the case, and that we have still to wait several months before the result of the deliberations of the Committee can be known. Sir Herbert Maxwell has sent the following letter to *The Times*, where it was published on Dec. 11th :—

To the Editor of The Times.

SIR,—As I have received numerous inquiries as to when the report of the Committee on the Meteorological Grant will be presented, and some complaints on the ground of delay, perhaps you will allow me to explain the circumstances.

The evidence was closed in July; the committee reassembled in October to consider report, and made considerable progress; but the serious illness of one member and the absence of another on the Continent have obliged us to defer the final meetings till February.

I am, Sir, your obedient servant,

HERBERT MAXWELL, *Chairman.*

Monreith, Dec. 9th.

METEOROLOGY AT THE BRITISH ASSOCIATION.

SECOND ARTICLE.

THE number of meteorological papers read at the Southport meeting of the British Association was greater than usual, and the interest shown in Meteorology was more apparent than at any meeting during the last nineteen years. As frequently happens at great gatherings, however, the informal intercourse of persons interested in a special subject proved more stimulating and helpful than the regular meetings for the reading and discussion of papers. The formal meetings attracted good audiences as a rule, and we give some account of such of the papers as could be obtained in abstract or were sufficiently interesting to be reported in the daily press.

It must be confessed, however, that the local newspapers, on which one usually relies to supplement the data obtained at the meetings which it was impossible to attend personally, preferred to put on record the debates on such subjects as the Fiscal Question and Education, near enough the borderland of science to catch some reflected warmth from the forbidden fires of politics; indeed, one reporter said in his haste, "Nobody cares for meteorology."

The following are the titles of papers of meteorological interest:—

Read on Thursday, 10th September.

In Section E. (Geography.)

Presidential Address, by Captain Ettrick W. Creak, C.B., F.R.S., dealing comprehensively with Terrestrial Magnetism.

Read on Friday, 11th September.

In Section A. (Mathematical and Physical Science.)

"Methods of Meteorological Investigation," by Dr. W. N. Shaw, F.R.S. [See this Magazine for October, pp. 151—159].

"On Simultaneous Solar and Terrestrial Changes," by Sir Norman Lockyer, K.C.B., F.R.S.

"On the Relation of the Rainfall of Scotland to the Sun-spot Periods 1855—98," by Dr. A. Buchan, F.R.S.—[An abstract of Dr. Buchan's results appeared in this Magazine for August, pp. 116-117].

"On Barometric Depressions," by M. Teisserenc de Bort.

"On the Origin and Forms of Hoar Frost," with lantern illustrations, by Dr. K. Grossman and Mr. J. Lomas.

In Section E.

"The Influence of Ice-melting on Oceanic Circulation," by Professor Otto Pettersson.

"An Experiment on the Melting of Ice in Salt Water," by Mr. J. W. Sandstrom.

"Afforestation of Waterworks Catchment Areas, with special reference to the case of Liverpool," by Mr. J. Parry, C.E.

On Monday, 14th September.

In Section A.

"On the Employment of the Hair Hygrometer in place of the Psychrometer," by Professor J. M. Pernter.

"On the General Circulation of the Atmosphere," by Professor H. H. Hildebrandsson.—[The results of the work were noticed in this Magazine for August, pp. 122-123].

"Report of the Kite Committee," by Mr. W. H. Dines [see below].

"Kite Observations at Blue Hill, 1900—02," by Mr. A. L. Rotch.

"Work of the International Aeronautical Committee," by Professor H. Hergesell.

"Phenomena accompanying the Volcanic Eruptions in the West Indies," by Mr. D. Burns.

On Tuesday, 15th September.

In Section A.

"Report of the Seismological Committee," by Professor J. Milne, F.R.S.

"Radiation from a Foggy Atmosphere," by Professor A. Schuster, F.R.S. [An abstract will be published in an early number].

"Solar Prominences and Terrestrial Magnetism," by Rev. A. L. Cortie.

"Comparison of the Spectrum of Nitrogen and of the Aurora," by Dr. A. Paulsen.

"Diurnal Variation of Temperature in the Levant and its relation to Radiation," by Dr. A. Buchan, F.R.S.

"Progress of the Magnetic Survey of the United States," by Mr. L. A. Bauer.

IN SECTION G. (Engineering.)

"Water Supply in South-West Lancashire," by Mr. J. Parry, C.E.

"Rainfall on the River Bann, Co. Down," by Mr. J. Smyth, C.E.—[The paper is printed in full on pp. 198-201].

"Rate of Fall of Rain at Seathwaite," by Dr. H. R. Mill.

[See this Magazine for November, p. 182].

On Wednesday, 16th September.

IN SECTION A.

"Report of the Ben Nevis Committee," by Dr. A. Buchan, F.R.S.—[We regret that we have not yet received a copy of this report, which was read from MS.]

"Self-recording Instruments," by Professor H. L. Callendar, F.R.S.

"A Study of Audibility as affected by Meteorological Conditions at Blue Hill during 1901," by Mr. A. L. Rotch.

"On some Rainfall Problems," by Dr. H. R. Mill.

Altogether an embarrassment of meteorological riches, and it is with real regret that we have to limit our notice in most cases to titles, which can only tantalize the reader who desires full information.

Investigation of the Upper Atmosphere by Means of Kites in co-operation with a Committee of the Royal Meteorological Society.—Second Report of the Committee, consisting of DR. W. N. SHAW (*Chairman*), MR. W. H. DINES (*Secretary*), MR. D. ARCHIBALD, MR. C. VERNON BOYS, DR. A. BUCHAN, DR. R. T. GLAZEBROOK, DR. H. R. MILL *and* PROFESSOR A. SCHUSTER. *Drawn up by the Secretary.*

The results of last year's work have been published; a description of the apparatus and methods employed being given in the *Quarterly Journal of the Royal Meteorological Society*, Vol. XXIX., No. 126, p. 65; and a discussion of the results obtained in a paper by Dr. Shaw and myself, which appears in the *Transactions of the Royal Society*, Series A, vol. 202, p. 123.

The apparatus used at Crinan last year was erected at Oxshott in the autumn, and it was hoped that to a limited extent the observations might be continued there; but before the end of October the wire was accidentally dropped across the main road leading from Esher to Leatherhead. Fortunately the wire rested on trees on both sides of the road; but before it could be removed many carriages and bicyclists had passed under it. This accident convinced me that it would be unwise to continue the work at Oxshott, excepting for winds between south and north-west, and the winter has been devoted to an endeavour to improve the apparatus.

This I hope has been accomplished: a new winding-gear has been constructed, which so far has given every satisfaction; and the details of the construction of the kites have been altered, so that they exert a more uniform pull and seem

to be more reliable. The apparatus was brought to Crinan at the beginning of August, and in view of the uncertainty about obtaining a vessel, was erected on the same island as last year. The apparatus in the possession of the Committee now consists of—

I. Engine, boiler, and winding-gear used last year.
II. New winding-gear.
III. About 14 miles of wire, six of which have been purchased this year.
IV. Ten kites 7 ft. 6 in. high; three kites 9 ft. high; materials of a kite 12 ft. high.
V. Two self-recording instruments made by M. Teisserenc de Bort.
VI. Spare bamboo sticks, &c., for repairs.

The old winding-gear is hardly reliable, but many of the parts will be available for making another.

Application was made to the Government Grant Committee of the Royal Society for a grant of £250 for the hire of a vessel. On the suggestion of this Committee the Admiralty were asked to lend a vessel for the purpose, and they had kindly consented to do so; but unfortunately the vessel they proposed to place at the disposal of the Kite Committee met with an accident and became unavailable. The Royal Society, however, made a grant of £200, but great difficulty was experienced in obtaining a suitable vessel owing to the lateness of the time at which inquiries about one were instituted, and to the fact that July and August are the yachting season. A steam tug, the "Renown," has been hired for a month, and reached Crinan on August 13th. The apparatus was fitted on board by the evening of the 14th, and since then daily ascents have been made. No great height (over 6,000 feet) has been reached, for the weather has been of the most unfavourable description for kite flying; but one very interesting trace has been obtained, namely, that of August 20th, when the kite was drawn in from a height of 4,500 feet during a sudden and unexpected thunderstorm which was accompanied by extremely violent rain and hail.

Mr. Dines stated when reading his report that the kite 12 feet high was constructed and used successfully on calm days. Although strong winds and wretched weather prevailed, he succeeded in getting 38 ascents, from 20 of which good records were obtained. This year there were only seven really good days for kite-flying during the stay at Crinan, but on that very account the contrast with the records obtained during the fine weather of last year promises to be interesting.

THE SOUTHPORT METEOROLOGICAL BREAKFAST.

By the courtesy of Mr. J. A. Kay, 211, Lord Street, Southport, we this month present our readers with a reduction of the photograph of the Meteorological Breakfast at Southport (see p. 149), to which we have added a key giving the names of those whom we are able to identify. Of the sixty-two who were at the breakfast, two at least do not appear in the photograph, either because they arrived late or were concealed from the camera by their neighbours. We understand that Mr. Kay is prepared to supply copies of the original photograph (size when mounted, 13 in. × 11 in., or unmounted 11 in. × 8 in.) at a moderate price.

THE METEOROLOGICAL EXHIBITION AT SOUTHPORT.

THE "Exhibition of Instruments, &c.," arranged in connection with the visit of the International Meteorological Committee to Southport was more elaborate and interesting than its official designation implies. The greatest novelty consisted of a complete weather-forecast office at work. The telegrams on which the Daily Weather Reports of the Meteorological Office are based were repeated to Southport each morning, a map was drawn on the spot, forecasts prepared, and a separate Daily Weather Report printed and published in Southport, independent of the London Report, though of course made from the same data. The close similarity of the two simultaneous reports proved at least that different forecasters could come to the same conclusions, and the result must be looked on as satisfactory.

The greater part of the Exhibition consisted of instruments and records, which might be divided into two classes:—*historical*, associated with the beginnings of modern meteorology; and *improved*, which will, we trust, be associated with fresh advances. There was a pleasing absence of instruments such as may be seen in any first-class instrument-maker's shop, or in most meteorological observatories. The value of these has been established and is fully recognised. Thanks to the general insistence on having certificates of accuracy with all instruments purchased and the firm rules of the leading meteorological institutions, it is no longer necessary to teach observers that good instruments are better than bad.

The catalogue contained 191 entries, but in order to gain space for the consideration of most of the more strictly meteorological, we have to pass over a number of very interesting exhibits bearing on terrestrial magnetism and other allied branches of cosmical physics.

Amongst the historic instruments which did good service in their day were Whewell's anemometer and Crossley's self-registering rain gauge, dating from 1841, aud exhibited by the Astronomer Royal, who also showed one of the wooden bowls used in Campbell's first pattern of sunshine recorder with a year's sunshine burnt into its surface. Later patterns were also exhibited, showing how the principle of this beautiful instrument remained unaltered while the details of construction were being improved, until Mr. R. H. Curtis's adjustable stand (exhibited by Mr. J. J. Hicks) brought the whole into its present efficient form. The Royal Meteorological Society showed the instruments used by the late Mr. Glaisher in his balloon ascents.

Amongst the less familiar instruments, the nephoscopes, or cloud mirrors, claim somewhat special notice, for there is, perhaps, no meteorological observation so unsatisfactorily made as a rule as the estimation of the amount and direction of motion of clouds. Three different patterns were shown by the Meteorological Office and Dr. W. N. Shaw. Perhaps the most interesting was Besson's portcullis nephoscope, in which a horizontal line of vertical spikes is

turned so that it coincides with the direction of motion of a cloud. This direction can then be read off on a graduated circular disc, and the angular velocity of the cloud's movement may also be measured by noting the time intervals as it passes from spike to spike.

The Kew Observatory sent the McLeod Sunshine Recorder, and Mr. A. Lander, of Canterbury, showed a new pattern of photographic sunshine recorder made of aluminium and provided with a revolving slit actuated by clockwork, instead of a lens, through which the light is thrown on the sensitive paper, giving a very sharp trace. The trouble with all photographic recorders which have to measure intensity of light is of course the difficulty of ensuring equal sensitiveness in successive batches of paper.

Mr. J. Baxendell, the director of the Fernley Observatory at Southport, whose absence from the meeting through illness was much regretted, showed several of his ingenious improvements and inventions. The most interesting was his self-recording anemoscope, both by itself for recording the direction of the wind and in combination with the Dines' pressure-tube anemometer. A neat little contrivance by which the annular space below the funnel of a 5-inch Snowdon rain gauge is converted into a hot water chamber, by which snow collected in the funnel may be melted, struck us as of considerable practical utility.

Mr. F. L. Halliwell showed the daily and weekly patterns of his beautiful recording rain gauge, the traces of which for the deluge that greeted the British Association on its opening day, attracted much attention on account of the sharpness with which the variations in intensity of fall were brought out by the curve.

Mr. R. W. Munro exhibited the latest patterns of Dines' anemometers adapted for obtaining automatic records either with the pressure-plate or the pressure-tube vane head.

The Cambridge Scientific Instrument Company brought forward several modifications of the Calendar platinum resistance thermometers adapted for giving automatic records of meteorological phenomena. The principle of all is the same: the change of resistance in a coil of platinum wire due to change of temperature upsets the balance of a Wheatstone bridge, and an automatic slider moves along a slide wire in the other arm of the bridge until the balance is restored; a pen attached to the slider records the changes upon a revolving drum. The principle is very simple, but the details present several points of great ingenuity, and the recorder, which is a large and solidly constructed instrument, is likely to be useful mainly in observatories where a trained staff is available. The thermometer is adapted for use as a sunshine recorder (or rather as a black-bulb solar radiation thermometer) by taking account of the difference in resistance of two coils, one of plain platinum wire, the other exactly similar but embedded in a thin layer of black enamel. For observing air temperature the change of resistance is measured in a fine copper wire wound on a light mica frame and enclosed in a

brass tube. This company also showed a novel device called the Blakesley Portable Barometer, the practical working of which it would be interesting to test. It consists of a straight tube closed at one end, open at the other and with a bore of about one-twentieth of an inch. The tube contains air shut in by a column of mercury about eight inches long. The length of this air space is read with the tube vertical, first with the closed end uppermost, then with the open end uppermost, and the barometric height is equal to the sum of the two readings divided by the difference of the two readings and multiplied by the length of the thread of mercury at 32° F. No temperature correction is required.

Messrs. Newton & Co. showed an altimeter designed for measuring the height of kites or balloons; and Mr. A. L. Rotch an instrument for showing the true direction and velocity of the wind at sea when its apparent direction and the speed of the ship are known. Mr. Dines exhibited his kites and winding gear; and Mr. P. Y. Alexander showed some of the unmanned balloons with which he has made interesting experiments at Bath.

Dr. W. N. Shaw exhibited the anemoidograph, a new instrument for tracing air trajectories of the kind described in this Magazine for July, p. 103; and also his thermopsychrophorus, the interesting performances of which before it had attained the dignity of so expressive a title were touched upon in this Magazine for April, 1902, p. 39.

Many interesting maps of meteorological and magnetic conditions were exhibited; we have space only to mention those showing the distribution of the stations of the Meteorological Office, and the Royal Meteorological Society, and of the 3636 rain gauges whose records appeared in "British Rainfall, 1902." Some interesting early synoptic charts, many records of special phenomena, and not a few striking photographs added to the interest of an exhibition which was much appreciated by the members of the British Association and reflected credit on its organizers, presided over by Dr. Shaw, and on Mr. R. G. K. Lempfert and Mr. Marriott in particular, to whose efforts the arrangement of the collection and the prompt publication of the catalogue were largely due.

Correspondence.

THE OCTOBER RAINFALL.

To the Editor of Symons's Meteorological Magazine.

THE Rainfall measured here in October was 8·88 in. and not 7·88 in. as given in my letter to you dated 2nd November.

I am, Sir, your obedient servant,

MORRIS BIRKBECK.

Dippen Hall Cottage, Farnham, Surrey, 9th Dec., 1903.

USE OF THE RAIN GAUGE ON SHIPBOARD.

To the Editor of Symons's Meteorological Magazine.

ACCORDING to Dr. W. N. Shaw, F.R.S., "we know practically nothing of the distribution of rainfall over the sea." This desideratum ought to be supplied. There is a form of rain gauge for use at sea. Is there no means of using it? Meteorologists would do well to give attention to this requirement now that it has become desirable to know the precipitation in various parts of the ocean, this being an important factor in the genesis and maintenance of cyclonic and electrical storms, as well as of oceanic currents; and without this knowledge the physics of the atmosphere over the oceans must be defective. Some knowledge of the frequency of rain over the oceans has been obtained from the log books of ships; but these documents give no account of the quantity of the rain. A rain gauge mounted on gimbals is made suitable for use on shipboard, but hitherto it has not been much employed. There are some difficulties in using it. When the most appropriate position is selected for its exposure, the water which it collects is not always, indeed seldom, entirely due to rain. There is always the liability of sea water being mixed with the rain water, for the sea comes on the ship often as spray, sometimes as topping waves. The problem is to find how much of the contents of the gauge at any time is due to rain and how much should be eliminated as sea water. A rule may be proposed for the purpose which apparently admits of sufficient accuracy.

The water collected by the gauge should be tested by an accurate glass hydrometer, such as is now very generally used on shipboard for observing the specific gravity of the surface water of the sea. Let the specific gravity of the collected water be s; that of the surface water must also be observed in the usual way; let it be S. The temperature must be noted at the same time, as usual. If the temperature is at or about 62°, the specific gravity of rain, that is of pure water is 1. The contents of the gauge should be examined regularly every day, or preferably at shorter intervals, say every four hours, commonly the observing interval at sea for meteorological conditions. Let the quantity of water be represented by Q; the part due to rain by x; then $Q-x$ will be the amount of sea water to be deducted. The observations s, S, Q yield the equation

$$x f + (Q-x)\,S = Q\,s\,;\ \text{whence}$$

$$x = \frac{Q\,(S-s)}{S-f}$$

Here f is the specific gravity of water, taken as 1 at the temperature of 62°, which becomes 1·0015 at 42°, 0·9976 at 82°, and for any other temperature may be known by interpolation near enough. The equation expresses the Rule: Multiply the quantity of water by the difference between its specific gravity and that of the sea water; divide the product by the difference between the specific gravity of

the sea water and that of fresh water at the same temperature; the result is the amount of rain.

Example:—Q = ·87 inch, s = 1·0095, S = 1·0267, temperature 51°.

Here $f = (1{\cdot}0015-1)\frac{11}{20} + 1 = 1{\cdot}0008$, and the equation becomes

$$x = {\cdot}87\ \frac{1{\cdot}0267-1{\cdot}0095}{1{\cdot}0267-1{\cdot}0008} = 0{\cdot}58 \text{ inch.}$$

Of course it would save the calculation if the gauge were unaffected by sea spray, having regard to good exposure to rain. The record should supply Time, Latitude, Longitude, Quantity collected, its specific gravity and that of the sea water, Temperature, Value of f used, Rain deduced. The last two items might be systematicaliy neglected, to be afterwards worked out by a computer. A table might be calculated for a more expeditious mode of reducing the observations.

RICHARD STRACHAN.

[For water of such low salinity as rain mixed with sea-spray in a ship's rain gauge, a hydrometer of very great delicacy would have to be employed. It would probably be found easier and more accurate to estimate the salinity by determning the chlorine chemically.—ED. *S.M.M.*]

SEASONAL RAINFALL OF 1902—3.

To the Editor of Symons's Meteorological Magazine.

WITH the month of November I bring to an end another year of *Seasonal* Rainfall, and a heavy record it proves, owing to the excess during the summer and autumn. Comparing the actual fall with the average of 1880—99, we get the following values:—

	1903.	1880—99.	Diff. 1903.
Winter (December—February)...	4·45 in.	5·14 in.	—0·69 in.
Spring (March—May).....	7·42 in.	4·81 in.	+2·61 in.
Summer (June—August)	13·74 in.	6·56 in.	+7·18 in.
Autumn (September—November)	10·20 in.	7·65 in.	+2·55 in.
Dec. 1902—Nov. 1903.....	35·81 in.	24·16 in.	+11·65 in.

These values show that, roughly speaking, we had the average fall for the whole year during the summer and autumn, when 67 per cent. of the total fall was recorded; and the excess of 1903 above the average during the winter and spring. The total number of wet days was 196, giving an average fall of ·18 inch per wet day—the largest average I have yet observed. I have gauged one fall of 2 inches, and four exceeding 1 inch. Snow has been almost conspicuous by its absence, only a total of ·13 inch being gauged on four days.

C. WIGAN HARVEY.

Throcking Rectory, Herts.

RAINFALL ON THE RIVER BANN, CO. DOWN, IRELAND, AT BANBRIDGE AND LOUGH ISLAND REAVY RESERVOIR, FOR 40 YEARS, FROM 1862 TO 1901.

By JOHN SMYTH, M.A., M.Inst.C.E.I., F.R.Met.Soc.

IN the year 1857, as engineer of the Bann Reservoir Company, I was engaged in an arbitration between that company and the riparian proprietors or occupiers of the lands adjoining the River Muddock, which were alleged to be flooded by an excessive amount of water sent down from the reservoir through that river (an affluent of the Bann) to supply the mills on the River Bann. In trying to show the arbitrators that the damage done was principally due to heavy rainfalls, too great for the capacity of the several streams passing through the lands, I was met by the difficulty of making calculations of the amount of water to be provided for, when I found no rain gauges had been kept in that neighbourhood or even near it. I, therefore, in the meantime having thoroughly studied the subject, commenced in the year 1861 to take rainfall observations. Amongst others, I established the gauges at Milltown, Banbridge and Lough Island Reavy, and now proceed to give an account of the observations taken by means of these gauges and the results obtained from them.

Milltown, Banbridge.

I have prepared a summary of the 40 years' observations to accompany this paper, giving the total rainfall for each year, and for each month of the year. The mean values of all these are given for periods of 10, 20, 30 and 40 years, so that by comparing these results with any year or portion of a year it will be seen whether the rainfall is below or above the average.

The average rainfall for the whole period was 31·1 inches. The greatest 10 year average was 33·3 in. from 1872 to 1881. The least 10 year average was 29·1 in. from 1862 to 1871. The wettest year was 1872, when 46·6 in. was registered. The driest, 1887, with 23·1 in. registered. The greatest fall in 24 hours was 2·3 in. on October 12th, 1865.

On July 4th, 1883, in one hour, 1·6 in. fell; this is an important point to know, as a guide to the capacity required for traps, grates and drains.

A copper gauge was used, 8 inches in diameter, the funnel 1 foot above the ground level, placed in a box.

The three consecutive driest years at Banbridge were 1885, 1886 and 1887, averaging 28·60 in.

Bann Reservoir at Lough Island Reavy.

I give also a summary of the 40 years' observations at this station, giving the same elements as in the case of Milltown, Banbridge.

The average rainfall for the whole period was 44·0 inches. The greatest 10 year average was 46·61 in. from 1863 to 1872. The least 10 year average 40·81 in. from 1873 to 1882. The wettest year was 1872, when 61·2 in. was registered. The driest was 1887, with a fall of 26·5 in. The three driest consecutive years were 1878 to 1880, when the average fall was 35·2 in. The greatest fall in 24 hours was 3·9 in., November 29th, 1868.

Bateman's mountain gauge was used for nearly all these observations up to 1892, when an ordinary copper 5 inch gauge was substituted. Bateman's gauge was of 8 inches diameter, read by means of a rod resting on a float, the reading being facilitated by a vernier carried on a temporary cover placed on the gauge for that purpose.

Foffanny, near Lough Island Reavy.

At the Belfast Meeting of the British Association, 1874, I read a paper on the Rainfall of Ulster, and in the discussion it was seen that there was a great want of gauges all over the country, and the Rainfall Committee of the Association supplied gauges to a number of suitable applicants whom I was enabled to induce to undertake the work. I was particularly anxious to get observations on the highest point possible near the reservoir, so employed a man called Patrick McAlinden, who lived in the highest inhabited house, to take the three years' observations which I herewith supply. It will be seen that the average at this high elevation (920 feet) is nearly double that at the reservoir; such, however, was to be expected from its position close to the higher range of mountains (rising to from 2000 to nearly 3000 feet) which intercept the southerly water-laden currents and cooling them cause them to precipitate their moisture as they pass over. I would have been glad, however, to have had a longer series, but McAlinden left the place and went to live near the Deers Meadow Mountain, where the River Bann rises. I got him to try the gauge there, at an elevation of 1300 feet, but two miles from his house; it was soon interfered with, however, so I removed it to Divis Mountain, near Belfast, where the late Mr. Lavens Ewart, employed a gamekeeper to observe, but the arrangement did not work well.

Rainfall at Foffanny, near Lough Island Reavy Reservoir, for the years 1875, 1876 *and* 1877.

Lat. 54° 12'. Lon. 6° 2' 30". Above sea level 920 ft. On Butter Mountain, 2½ miles on Muddock River above intake to Lough Island Reavy Reservoir. Mountain rain gauge, 8 in. diameter, 3 ft. above surface of ground.

Month.	1875.	1876.	1877.
	in.	in.	in.
January	17·73	5·00	16·15
February	1·93	7·50	2·60
March	3·04	2·63	3·90
April	·90	5·20	10·10
May	4·25	·60	6·50
June	6·25	3·90	4·15
July	6·00	1·74	6·00
August	5·86	7·82	5·50
September	11·60	8·72	3·75
October	12·25	9·15	7·00
November	9·30	11·37	10·00
December	4·75	19·05	8·50
	83·86	82·68	84·15

Ten Years' Averages.

Milltown, Banbridge.		in.	Bann Reservoir, Reavy.		in.
1862–1871	.....	29·13	1863–1872	.....	46·61
1872–1881	.....	33·27	1873–1882	.....	40·81
1882–1891	.....	31·25	1883–1892	.....	42·82
1892–1901	.....	30·63	1893–1902	.....	46·34
40 years' average		31·07	40 years' average		44·15

Summary of Rainfall at Milltown, Banbridge, co. Down.

Lat. 54° 15′ N. Lon. 6° 18′ W. 200 ft. above sea level.

YEAR.	Jan.	Feb.	Mar.	Apl.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	TOTAL.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1862.....	3·6	1·0	2·7	2·8	3·8	2·8	3·5	1·8	1·9	3·6	2·6	3·1	33·2
1863.....	3·1	0·8	1·7	1·3	2·5	2·7	0·8	3·8	3·0	5·6	2·3	1·8	29·4
1864.....	1·4	1·2	2·0	2·1	1·8	2·6	1·3	2·4	2·5	2·4	3·5	2·0	25·2
1865.. ...	2·7	2·7	2·2	0·6	4·2	0·5	1·5	2·7	0·3	6·0	3·5	2·2	29·1
1866.....	3·5	2·3	2·5	1·5	0·9	2·1	2·1	2·7	3·5	2·0	2·3	2·7	28·1
1867.....	3·7	1·7	2·0	3·8	2·9	1·0	6·4	2·0	1·7	4·3	0·8	1·6	31·9
1868.....	2·5	2·2	2·9	2·1	2·3	0·7	0·9	4·0	1·6	1·8	2·5	4·5	28·0
1869.....	3·4	4·1	1·9	2·0	2·1	0·9	1·5	1·6	3·9	1·5	3·1	3·2	29·2
1870.....	3·0	2·4	1·1	1·1	1·6	1·0	1·8	1·6	2·5	7·2	1·8	2·5	27·6
1871.....	3·1	2·8	1·4	2·9	0·8	1·8	4·0	3·4	3·6	2·3	1·6	1·9	29·6
Average of 10 years	3·0	2·2	2·0	2·0	2·3	1·6	2·4	2·6	2·4	3·7	2·4	2·5	29·1
1872.....	4·1	3·5	2·4	4·1	2·7	3·6	3·3	4·2	4·4	4·5	4·2	5·6	46·6
1873.....	4·0	1·1	2·3	0·5	1·9	1·5	4·1	4·4	2·7	2·7	1·8	0·6	27·6
1874.....	1·7	1·8	1·3	1·7	0·7	1·1	2·9	4·4	2·9	3·6	3·2	3·0	28·3
1875.....	3·9	1·8	1·0	0·4	1·5	3·3	3·9	2·4	4·7	3·5	3·3	1·7	31·4
1876.....	1·1	3·4	2·9	2·1	0·5	2·0	2·0	2·9	3·4	4·5	3·5	7·7	36·0
1877.....	5·9	2·4	3·6	3·1	3·5	2·4	4·8	3·4	2·1	2·7	3·3	2·8	40·0
1878.....	3·1	2·0	1·5	1·4	3·8	3·0	0·4	2·5	3·3	2·9	1·5	1·5	26·9
1879.....	2·3	1·5	2·0	1·7	3·8	4·0	6·1	3·8	4·4	1·1	1·3	1·3	33·3
1880.....	1·0	2·5	1·8	3·7	0·6	2·9	4·8	0·9	3·2	1·2	2·4	2·6	27·6
1881.....	0·7	2·8	2·9	1·7	2·6	4·2	2·9	4·7	2·2	3·5	3·8	3·0	35·0
Average of 20 years	2·9	2·2	2·1	2·0	2·2	2·2	3·0	3·0	2·9	3·3	2·6	2·7	31·1
1882.. ...	1·9	2·1	2·4	2·7	2·9	3·1	5·0	3·6	4·3	2·4	4·6	2·6	37·6
1883.....	3·5	3·1	1·5	1·4	2·0	2·1	4·7	3·8	3·7	2·6	3·3	1·9	33·6
1884.....	3·8	3·4	2·7	1·9	2·1	0·8	2·9	1·8	3·0	2·4	2·5	3·1	30·4
1885.....	2·2	3·7	1·6	2·0	1·8	0·7	1·9	1·4	4·6	3·1	1·6	2·0	26·6
1886	3·8	2·1	2·6	1·4	5·1	1·4	3·5	2·4	2·4	4·1	2·9	4·4	36·1
1887.....	2·5	1·0	1·5	2·0	1·5	0·7	2·7	2·1	3·0	1·9	2·5	1·7	23·1
1888.....	1·8	0·5	3·4	1·7	2·7	4·4	4·6	2·7	1·0	1·1	3·9	2·4	30·2
1889.....	1·8	2·1	2·3	3·3	3·4	0·3	3·7	7·6	1·7	3·2	1·6	2·9	33·9
1890.....	3·3	1·3	2·7	1·1	1·5	2·9	2·1	2·6	3·2	1·5	6·0	1·7	29·9
1891.....	1·1	0·2	1·2	2·5	3·1	3·0	2·9	5·3	1·9	3·6	2·4	3·9	31·1
Average of 30 years	2·8	2·1	2·3	2·0	2·3	2·1	3·1	3·1	2·9	3·1	2·8	2·7	31·2
1892.....	2·1	1·8	0·6	0·8	3·4	3·1	2·6	5·5	2·9	3·0	3·5	1·8	31·1
1893.....	2·7	2·5	0·7	1·1	0·9	1·6	2·7	4·3	1·7	1·8	1·4	2·6	24·0
1894.....	2·9	1·9	1·1	2·4	1·6	3·5	3·3	2·3	0·3	5·0	1·7	2·8	28·8
1895.....	1·9	0·7	3·1	2·0	0·2	2·5	4·7	5·0	0·5	3·5	3·4	2·8	30·3
1896.....	1·7	1·3	3·0	1·3	0·3	2·5	7·4	2·0	4·5	2·1	0·7	3·8	30·6
1897.....	1·8	1·8	4·2	2·4	1·7	4·5	1·7	4·0	2·1	2·2	3·2	3·2	32·8
1898.....	1·2	2·6	0·9	3·5	3·7	3·0	0·6	3·6	4·8	3·2	2·0	1·9	31·0
1899.....	2·9	2·5	1·4	2·9	3·6	2·4	3·5	1·2	3·4	1·8	2·8	4·0	32·3
1900	2·0	2·3	0·9	1·7	2·7	3·2	3·0	4·8	1·8	3·6	4·9	3·2	34·1
1901.....	2·8	1·4	2·1	2·1	1·5	2·7	1·1	4·3	3·5	2·6	4·0	3·2	31·3
Average of 40 years	2·6	2·1	2·2	1·8	2·2	2·3	3·1	3·2	2·8	3·0	2·8	2·8	31·1
1902.....	1·9	2·5	1·6	2·6	3·5	2·2	3·6	2·4	3·7	1·3	3·3	2·4	31·0
1903.....	*4·3*	*1·8*	*3·9*	0·9	2·3	1·2	6·0	5·1	3·9	...	...	...	...

Summary of Rainfall at Bann Reservoir, Lough Island Reavy, near Castlewellan.

Lat. 54° 15′ N. Lon. 6° 2′ W. 440 ft. above sea level.

Diameter of Gauge 8 in. up to 1892, after which 5 in. Plane of receiver 1 ft. above ground.

Year.	Jan.	Feb.	Mar.	Apl.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1862.....	6·0	2·6	5·6	3·3	3·0	5·0	4·4	2·0	2·0	5·7	5·0	8·3	52·9
1863.....	4·3	1·0	4·9	1·0	2·4	3·4	0·8	5·2	2·0	11·8	3·5	2·5	42·8
1864.....	5·2	1·2	6·7	2·0	1·7	2·7	1·6	1·8	3·1	4·5	10·3	3·9	44·7
1865.....	5·0	3·7	1·9	0·5	4·6	0·8	2·9	4·5	0·3	12·0	9·3	6·8	52·3
1866.....	7·7	4·0	8·4	3·9	0·9	5·0	1·4	4·0	6·4	4·8	3·9	4·2	54·6
1867.....	4·4	2·0	7·1	5·0	8·2	0·5	6·5	1·7	3·0	6·6	0·5	1·7	47·2
1868.....	3·8	1·7	3·1	1·3	2·4	0·2	0·4	7·0	2·5	1·9	7·9	11·1	43·3
1869.....	7·1	2·6	1·9	1·2	2·1	0·1	1·2	1·6	4·7	0·8	1·9	3·7	28·9
1870.....	5·9	8·4	0·9	0·8	3·4	0·5	0·9	1·6	2·8	14·7	2·5	5·7	48·1
1871.....	4·5	6·5	2·1	5·3	0·5	1·8	3·3	2·4	5·7	5·0	3·3	2·6	43·0
Average of 10 years	5·4	3·4	4·3	2·4	2·9	2·0	2·3	3·2	3·2	6·8	4·8	5·1	45·8
1872.....	7·2	9·0	3·0	3·6	1·5	3·3	3·1	3·3	4·0	5·4	6·8	11·0	61·2
1873.....	6·2	0·8	4·4	0·3	1·2	1·9	4·2	3·9	1·9	1·6	4·0	0·8	31·2
1874.....	2·1	4·0	0·8	3·0	0·3	0·7	2·0	3·9	4·8	6·3	3·6	4·0	35·5
1875.....	7·1	1·2	1·4	0·3	2·2	3·8	3·2	2·8	5·6	6·3	5·1	2·4	41·4
1876.....	2·3	3·7	2·1	2·0	0·2	2·0	0·8	3·4	5·8	8·9	8·7	13·0	52·9
1877.....	11·9	1·7	3·6	5·6	3·8	3·3	2·7	4·2	1·9	3·8	6·0	5·6	54·1
1878.....	2·2	4·2	0·4	1·8	6·9	2·9	0·4	2·6	4·8	4·1	0·9	0·7	31·9
1879.....	2·7	3·0	2·2	3·5	1·6	6·1	5·9	4·7	7·2	0·9	0·9	1·1	39·8
1880.....	1·1	4·4	1·7	5·8	0·1	3·0	6·2	0·3	4·5	2·3	3·5	0·9	33·8
1881.....	0·4	4·6	4·7	0·7	0·8	4·0	0·8	3·6	1·2	2·8	6·0	4·8	34·4
Average of 20 years	4·8	3·5	3·3	2·5	2·4	2·6	2·6	3·2	3·7	5·5	4·7	4·7	43·7
1882.....	1·6	5·9	2·5	6·1	2·4	2·7	4·7	4·5	4·4	6·9	6·6	4·8	53·1
1883.....	5·8	9·2	1·9	1·8	1·3	0·7	2·5	3·5	9·0	4·0	2·7	0·9	43·3
1884.....	5·7	7·9	7·4	2·1	2·5	0·3	3·0	1·3	1·9	1·7	4·3	2·5	40·6
1885.....	3·8	6·0	2·4	6·6	2·0	0·4	0·8	2·1	7·4	4·0	5·0	0·4	40·9
1886.....	2·2	2·2	3·4	1·8	5·7	1·3	3·3	2·0	2·2	9·1	3·8	5·3	42·3
1887.....	3·9	1·0	0·7	1·3	1·0	0·8	3·1	3·0	3·1	2·5	4·0	2·1	26·5
1888.....	1·6	0·0	5·6	2·8	4·1	5·2	6·6	1·5	0·5	1·2	8·4	5·8	43·3
1889.....	6·3	0·4	3·2	6·1	6·3	0·0	3·5	4·6	2·5	7·6	0·9	3·3	44·7
1890.....	4·8	2·7	5·7	2·0	2·5	2·8	2·0	4·2	4·4	1·3	10·9	3·0	46·3
1891.....	1·6	0·3	1·8	6·3	3·5	6·5	2·9	8·4	2·5	10·4	8·7	6·1	59·0
Average of 30 years	4·5	3·5	3·4	2·9	2·6	2·4	2·8	3·3	3·7	5·3	5·0	4·3	43·8
1892.....	4·1	1·9	0·5	0·9	4·2	3·6	1·8	6·2	3·9	6·9	6·0	1·3	41·3
1893.....	5·7	3·6	0·6	1·2	1·0	1·8	2·9	4·6	1·5	1·5	2·6	6·1	33·1
1894.....	5·9	2·9	0·6	4·5	4·0	3·8	3·9	2·2	0·3	10·9	5·7	3·9	48·6
1895.....	3·6	0·5	4·9	3·7	0·1	1·2	5·2	6·9	0·3	3·5	8·1	4·1	42·1
1896.....	1·8	2·8	3·7	1·0	0·4	3·4	6·7	1·9	6·8	2·4	2·2	7·2	40·3
1897.....	3·1	2·7	6·8	3·4	1·6	6·1	1·7	6·9	2·4	4·1	3·8	5·9	48·6
1898.....	1·9	2·8	1·0	6·7	4·6	4·3	0·5	3·7	4·0	5·1	4·5	3·9	43·0
1899.....	5·5	5·7	2·0	4·6	4·6	3·2	3·6	1·8	3·6	1·4	5·5	8·4	49·9
1900.....	3·3	5·4	1·0	2·6	4·9	3·4	4·4	5·1	1·2	5·7	7·2	4·9	49·1
1901.....	6·9	3·4	3·3	4·3	2·2	3·7	1·7	3·3	7·0	4·6	4·6	4·6	49·6
Average of 40 years	4·4	3·4	3·2	3·0	2·7	2·6	3·0	3·5	3·6	5·1	5·0	4·5	44·0
1902.....	3·3	5·6	2·2	5·1	7·0	4·1	5·2	4·5	4·8	2·7	9·8	4·9	59·2
1903.....	7·4	5·0	7·6	1·8	2·8	1·2	5·7	5·9	5·2	...	...	...	...

THE ELEVEN MONTHS' RAINFALL OF 1903.

Aggregate Rainfall for January—November, 1903.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	15·95	176	Arncliffe ...+	21·75	139	Braemar ...+	9·50	130
Tenterden .....+	6·51	127	Hull .....+	5·63	125	Aberdeen ...+	8·49	130
Hartl'y W'ntn'y+	13·40	159	Newcastle...+	9·05	139	Cawdor .....+	5·55	120
Hitchin .....+	14·35	167	Seathwaite +	34·36	129	Glencarron +	20·50	125
Winslow .....+	11·91	155	Cardiff .....+	14·57	141	Dunrobin ...+	8·26	130
Westley.....+	7·07	130	Haverf'dwest+	13·37	135	Darrynane +	6·07	114
Brundall.....+	5·25	123	Gogerddan +	17·86	145	Waterford +	9·32	127
Alderbury .....+	11·62	147	Llandudno +	8·14	130	Broadford..+	11·27	138
Ashburton .....+	15·43	135	Dumfries ...+	17·94	146	Carlow .....+	11·36	138
Polapit Tamar +	14·43	144	Lilliesleaf ...+	12·89	147	Dublin .....+	5·05	120
Stroud .....+	13·64	155	Colmonell ...+	9·09	123	Mullingar...+	12·68	138
Woolstaston ...+	14·48	155	Glasgow ...+	20·06	162	Ballinasloe +	10·53	132
Boston .....+	9·93	153	Inveraray ...+	18·19	128	Clifden .. ...+	7·83	111
Hesley Hall ...+	6·36	133	Islay .....+	12·28	130	Crossmolina +	13·27	129
Derby.....+	9·16	144	Mull .....+	13·51	127	Seaforde ...+	11·37	135
Bolton .....+	11·64	131	Loch Leven +	16·74	152	Londonderry+	6·99	119
Wetherby .....+	14·50	167	Dundee .....+	7·41	130	Omagh .....+	14·90	142

The rainfall in November was for the first time since February below the monthly average at most stations. If it had not been for a depression with very heavy rainfall which crossed our islands on the 27th, the month would have been extremely dry. Consequently the rainfall for the year to date shows a less remarkable excess over the average than it did at the end of October, although the excess over the average of the ten years 1890–99 amounts to about 43% for England and Wales, 34% for Scotland and 29% for Ireland.

METEOROLOGICAL NEWS AND NOTES.

THE ROYAL METEOROLOGICAL SOCIETY held its opening meeting for the new session on November 18th, when a communication on the Great Dust Fall of February, 1903, was submitted by Dr. H. R. Mill and Mr. R. G. K. Lempfert. We are obliged to hold over our report until next month.

IN BINDING THIS VOLUME our readers will please note that the photograph accompanying the present number is to be placed as a frontispiece. New reader may be reminded that the last number of Volume XXXVIII. will be published on January 16th, and will contain the usual index.

REVIEWS.

Die Luftströmungen auf dem Gipfel des Säntis (2504 *m.*) *und ihre jährliche Periode.* [The air currents on the summit of the Säntis (8215 ft.) and their annual period.] Von J. HANN. From the *Sitzber. k. Akad. Wiss. Wien, Math.-naturwiss. Klasse; Bd.* CXII. *Abt.* II. *a.* Vienna: 1903. Size, 9½ × 6. Pp. 42.

THE unwearied activity of Dr. Hann has led him to discuss in detail the hourly observations of wind made at the high-level Alpine observatory on the Säntis and to compare them with similar observations at low-level stations. He says the work was made "inviting and light" by the way the observations were published by M. Billwiller, the head of the Swiss meteorological service. Westerly winds were found to predominate at the summit both in frequency and intensity, the average direction for the fifteen years considered being nearly W.S.W. The wind in summer averages nearly true west, in winter north-east, and in autumn nearly south. The contrast with Zürich is very marked, both by the comparative absence of calms at the higher station and the relative frequency of easterly winds at the lower.

Monthly Record of Bright Sunshine measured at Upton, near Slough. [By RICHARD BENTLEY.] *Privately printed.* Size, 10 × 6. Pp. 10.

MR. BENTLEY'S record of sunshine was taken with a Campbell-Stokes Recorder and commenced in May, 1898. Records are given for five years to 1902. Of the four complete years the sunniest was 1899, with 1754¾ hours; the dullest, 1902, with 1355½. The sunniest month was July, 1900, with over 9⅓ hours sunshine per day as an average; the dullest month was December, 1900, when the average duration of sunshine was only 1 hour per day. The longest succession of sunny days was 105, from June 21st to October 3rd, 1901; the longest succession of sunless days was only 7, in December, 1899, and again in December, 1902.

Weather Warnings. By J. REGINALD ASHWORTH, D.Sc. (Reprinted from the *Transactions* of the Rochdale Literary and Scientific Society). Rochdale: 1903. Size, 8½ × 6. Pp. 4.

DR. ASHWORTH has tested certain weather prognostics and gives the result of two years' observations. The most complete are—(1) The rosy glow after sunset, which was observed 59 times and followed by a fine day on 52 occasions, by a wet day on 7. (2) Smoke rising vertically from chimneys, which was noticed 48 times and was followed by a fine day on 42 occasions, by a wet day on 6. (3) Smoke hanging round the tops of chimneys, which was observed 21 times and was followed by a wet day on 15 occasions, by a fine day on 6. It is always interesting to find the truth of old weather proverbs demonstrated by observation.

RAINFALL AND TEMPERATURE, NOVEMBER, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date
			inches.	inches.	in.						
I.	ENGLAND.	London (Camden Square) ...	1·85	— ·37	1·05	27	12	57·2	1	29·9	20
II.		Tenterden	2·33	— ·24	1·12	27	19	57·0	2	30·0	20
,,		Hartley Wintney	1·76	— ·72	·87	27	10	54·0	1*a*	29·0	19*e*
III.		Hitchin	2·15	— ·27	1·05	27	16	54·0	9	27·0	6, 19
,,		Winslow (Addington)	1·68	— ·79	·78	27	15	56·0	10	25·0	20
IV.		Bury St. Edmunds (Westley)	2·18	— ·32	1·01	27	16	55·0	2	28·0	30
,,		Norwich (Brundall)	1·87	— ·59	·26	2	23	56·0	2	28·2	7
V.		Winterborne Steepleton	1·91	...	·64	27	15	55·2	2	26·0	20
,,		Torquay	1·44	...	·73	27	12	58·7	1	33·4	30
,,		Polapit Tamar [Launceston]..	3·42	— ·46	·89	27	21	56·3	2	23·3	19
VI.		Stroud (Upfield)	1·59	— 1·10	·70	27	10	55·0	13	27·0	19
,,		Church Stretton (Woolstaston)	2·70	— ·08	1·00	27	20	54·0	12	25·0	30
,,		Worcester (Diglis Lock)	1·25	— ·85	·53	27	13	...	...	...	...
VII.		Boston	1·59	— ·26	·50	27	11	52·0	21	28·0	19
,,		Hesley Hall [Tickhill].....	1·16	— ·78	·33	27	13	55·0	10*b*	25·0	7, 19
,,		Derby (Midland Railway).....	1·96	+ ·03	·52	27	18	55·0	4	27·0	6
VIII.		Bolton (The Park).....	4·71	+ 1·20	·67	14	23	53·7	1	28·0	19
IX.		Wetherby (Ribston Hall) ...	1·79	— ·17	·31	2	18	...	...	...	...
,,		Arncliffe Vicarage.....	3·35	— 2·72	·48	14	23	...	...	...	...
,,		Hull (Pearson Park).	1·63	— ·66	·32	2	17	56·0	10	27·0	30
X.		Newcastle (Town Moor)	2·04	— ·42	·50	30	16	...	...	...	...
,,		Borrowdale (Seathwaite).....	9·70	— 4·28	1·29	23	19	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	2·36	— 1·60	·54	27	20	...	...	...	...
,,		Haverfordwest	3·35	— 1·51	1·07	1	17	56·6	2	25·4	19
,,		Aberystwith (Gogerddan) ...	6·01	+ 1·06	1·42	27	16	61·0	13	20·0	18
,,		Llandudno.....	3·89	+ ·55	·85	27	21	59·0	12	32·0	19*f*
XII.		Cargen [Dumfries]	3·62	— ·92	·61	8	17	56·0	4	22·0	30
XIII.		Edinburgh (Royal Observatory)	1·47	...	·55	28	14	54·9	12	25·6	30
XIV.		Colmonell	4·92	+ ·28	·74	24	20	56·0	1	21·0	29
XV.		Tighnabruaich	5·83	...	·68	14	22	51·0	4	27·0	29
,,		Mull (Quinish).....	5·36	— ·61	·84	23	23	...	...	...	...
XVI.		Loch Leven Sluices	1·63	— 2·02	·39	28	13	...	...	...	...
,,		Dundee (Eastern Necropolis)	·85	— 1·96	·20	2	14	55·6	12	26·0	30
XVII.		Braemar	1·99	— 1·78	·36	13	20	51·2	6, 12	20·2	30
,,		Aberdeen (Cranford)	3·45	+ ·09	·54	15	24	55·0	5	24·0	6
,,		Cawdor (Budgate)	3·40	+ ·66	·55	14	22	..	...	...	...
XVIII	SCOTLAND.	Strathconan (Dalbreac)	5·85	+ ·20	·73	10	14	...	...	...	...
,,		Glencarron Lodge.....	11·69	+ 1·77	2·19	23	28	55·2	13	19·0	30
XIX.		Dunrobin	4·78	+ 1·49	·87	14	16	55·0	14	25·0	30
,,		Castletown.....	5·27	...	·69	14	24	52·0	11	22·0	27
XX.		Darrynane Abbey.....	3·09	— 1·86	·75	1	22	...	...	33·0	30
,,		Waterford (Brook Lodge) ...	2·10	— 1·42	·63	13	9	56·0	12	23·0	19
,,		Broadford (Hurdlestown) ...	2·44	— ·81	·42	11	21	52·0	18	28·0	29
XXI.		Carlow (Browne's Hill)	2·73	— ·34	·46	28	13	...	...	...	...
,,		Dublin (Fitz William Square)	2·13	— ·43	·62	28	16	60·0	12	29·2	30
XXII.	IRELAND.	Ballinasloe	2·35	— 1·22	·42	11	22	61·0	11*c*	23·0	30
,,		Clifden (Kylemore)	4·70	— 3·24	1·10	13	22	...	...	...	...
XXIII		Seaforde.....	2·06	— 1·64	·70	28	19	53·0	10*d*	26·0	29
,,		Londonderry (Creggan Res.).	3·99	+ ·12	·73	27	25	...	...	...	...
,,		Omagh (Edenfel)	3·04	— ·67	·64	27	26	54·0	11	26·0	30

+ Shows that the fall was above the average ; — that it was below it.

a and 9, 10. b and 12, 13, 14, 23. c and 13. d and 11. e and 25, 30. f and 30.

SUPPLEMENTARY RAINFALL, NOVEMBER, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Harrow Weald	1·85	XI.	Llandefaelog-fach.....	2·82
II.	Dorking, Abinger Hall .	2·53	,,	New Radnor, Edmol.....	3·06
,,	Sheppey, Leysdown	2·62	,,	Rhayader, Nantgwillt ...	6·49
,,	Hailsham	2·33	,,	Lake Vyrnwy	3·75
,,	Crowborough.....	2·56	,,	Ruthin, Plâs Draw	2·95
,,	Ryde, Beldornie Tower..	1·45	,,	Criccieth, Talarvor	5·59
,,	Bournemouth, Kempsey	1·70	,,	I. of Anglesey, Lligwy..	3·24
,,	Emsworth, Redlands ...	1·76	,,	Douglas, Woodville.....	4·21
,,	Alton, Ashdell	1·92	XII.	Stoneykirk, Ardwell Ho.	3·35
,,	Newbury, Welford Park	2·05	,,	Dalry, Old Garroch	5·46
III.	Oxford, Magdalen Coll..	1·40	,,	Moniaive, Maxwelton Ho.	4·25
,,	Banbury, Bloxham	1·38	,,	Lilliesleaf, Riddell	1·86
,,	Pitsford, Sedgebrook ...	1·49	XIII.	N. Esk Res. [Penicuick]	3·25
,,	Huntingdon, Brampton.	2·30	XIV.	Dalry, Blair	...
,,	Wisbech, Bank House...	1·82	,,	Glasgow, Queen's Park..	2·70
IV.	Southend	2·85	XV.	Inveraray, Newtown ...	6·83
,,	Colchester, Lexden	1·98	,,	Ballachulish, Ardsheal...	7·78
,,	Saffron Waldon, Newport	1·77	,,	Campbeltown, Redknowe	4·80
,,	Rendlesham Hall	1·96	,,	Islay, Eallabus.....	5·63
,,	Swaffham	1·63	XVI.	Dollar.....	1·68
V.	Salisbury, Alderbury ...	1·31	,,	Balquhidder, Stronvar...	...
,,	Bishop's Cannings	2·04	,,	Coupar Angus Station...	·86
,,	Ashburton, Druid House	2·97	,,	Blair Atholl	2·00
,,	Okehampton, Oaklands.	4·43	,,	Montrose, Sunnyside ...	1·57
,,	Hartland Abbey	3·09	XVII.	Alford, Lynturk Manse..	2·71
,,	Lynmouth, Rock House	3·23	,,	Keith H.R.S.....	3·33
,,	Probus, Lamellyn	3·10	XVIII.	Fearn, Lower Pitkerrie..	2·95
,,	Wellington, The Avenue	1·99	,,	S. Uist, Askernish	5·60
,,	North Cadbury Rectory	1·95	,,	Invergarry.....	6·97
VI.	Clifton, Pembroke Road	1·91	,,	Aviemore, Alvey Manse.	3·50
,,	Ross, The Graig	1·18	,,	Loch Ness, Drumnadrochit	3·61
,,	Shifnal, Hatton Grange	2·29	XIX.	Invershin	5·65
,,	Wem Rectory	2·27	,,	Bettyhill	5·88
,,	Cheadle, The Heath Ho.	2·96	,,	Watten H.R.S.....	4·93
,,	Coventry, Kingswood ...	1·93	XX.	Cork, Wellesley Terrace	1·64
VII.	Market Overton	1·85	,,	Killarney, District Asyl.	2·90
,,	Grantham, Stainby	1·88	,,	Glenam [Clonmel]	1·44
,,	Horncastle, Bucknall ...	1·53	,,	Ballingarry, Hazelfort...	2·64
,,	Worksop, Hodsck Priory	1·41	,,	Miltown Malbay	3·62
VIII.	Neston, Hinderton	3·46	XXI.	Gorey, Courtown House	2·19
,,	Southport, Hesketh Park	3·06	,,	Moynalty, Westland ...	2·43
,,	Chatburn, Middlewood.	3·60	,,	Athlone, Twyford	2·38
,,	Duddon Val., Seathwaite Vic.	6·86	,,	Mullingar, Belvedere ...	2·68
IX.	Langsett Moor, Up. Midhope	2·85	XXII.	Woodlawn	2·87
,,	Baldersby	1·26	,,	Westport, Murrisk Abbey	3·33
,,	Scalby, Silverdale	2·95	,,	Crossmolina, Enniscoe ..	4·59
,,	Ingleby Greenhow Vic..	2·47	,,	Collooney, Markree Obs.	3·82
,,	Middleton, Mickleton ...	2·08	XXIII.	Enniskillen, Portora ...	2·55
X.	Beltingham	2·16	,,	Warrenpoint.....	2·02
,,	Bamburgh	2·10	,,	Banbridge, Milltown ...	2·07
,,	Keswick, The Bank.....	3·46	,,	Belfast, Springfield	2·59
,,	Melmerby Rectory	2·54	,,	Bushmills, Dundarave..	4·25
XI.	Llanfrechfa Grange	1·84	,,	Stewartstown	2·37
,,	Treherbert, Tyn-y-waun	5·56	,,	Killybegs	...
,,	Castle *Malgwyn*	3·12	,,	Horn Head	3·78

METEOROLOGICAL NOTES ON NOVEMBER, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Until the 27th the R was very light and the weather on the whole was fair and mild, but dull and cloudy. On the 27th and 28th 1·38 in. of R fell during a deep depression, bringing the total to within half-an-inch of the average. There was very little fog. Slight S on 30th. Mean temp. 44°·8, or 1°·8 above the average.

ABINGER HALL.—Mild and genial throughout, with 1·43 in. of R on 27th.

TENTERDEN.—Very little R till the 27th. Three or four inches of S on 30th. Gales on 21st and 27th. Duration of sunshine 64·6 hours.

CROWBOROUGH.—Dull and cold on the whole, but more or less sun on 18 days. Till the 25th it was dry, but heavy R fell on the subsequent days. S on the night of the 29th. Frost on 10 nights. Mean temp. 43°·5.

HARTLEY WINTNEY.—Beautifully fine until the last few days. Little fog or frost. Storm of wind and R on 27th, followed by colder days till the end. Ozone every day; mean 4·35.

WINSLOW, ADDINGTON.—Not much R until the end, and the land was getting dry, so that it was possible to get over fields in comfort. But the R of 27th and 28th brought back the state of saturation and covered the meadows with water. Some S on 30th.

PITSFORD, SEDGEBROOK.—Dry, but dark and gloomy. R ·93 in. below the average of 10 years. Mean temp. 42°·2. Hoar frost on several nights.

BURY ST. EDMUNDS, WESTLEY.—R fell in small quantities till the 27th, when 1·01 in. fell in 24 hours causing floods.

TORQUAY, CARY GREEN.—R 2·37 in. below the average. Up to 22nd only ·22 in. fell. Mean temp. 48°·8, or 1°·4 above the average. Duration of sunshine 92·6 hours, or 29·0 hours above the average. Mean amount of ozone 4·9; max. 8·5 on 21st with W.N.W. wind; min. 1·0 on 19th with N.W. wind.

WELLINGTON, THE AVENUE.—The driest month of the year except February and one of the finest. R about 1·25 in. below the normal amount.

NORTH CADBURY RECTORY.—The least abnormal month since January. The number of wet days was very large, but the R below the average. Temp. slightly below the average. The month ended with a bright, quiet frost in spite of the deep barometric depression.

CLIFTON, PEMBROKE ROAD.—A whole day's R on 2nd was followed by a week of dry weather with easterly winds and morning fog. Westerly winds prevailed for the rest of the month, with frequent light R and strong winds. Frost on 29th and 30th, with N.E. winds. R 1·50 in. below the average.

ROSS, THE GRAIG.—Very fine and a contrast to October. Tender plants were not injured till the 4th, which is late, although a fortnight earlier than in 1902. R less than half the average. Although there were several severe frosts, the mean temp. was slightly above the average.

BOLTON, THE PARK.—From 1st to 9th fine and calm weather prevailed, afterwards the weather was less settled. The temp. was above the average until the 19th and again from 21st to 29th, the mean being 42°·7, or 0·1 below the average. Bright sunshine on 19 days, making a total of 41·25 hours, or 15·7 hours above the average, and the greatest amount in any November since 1886, when 41·7 hours was reached. The total R for the 11 months of 1903 was 49·19 in., or 3·70 in. more than the previous greatest annual fall.

SEATHWAITE VICARAGE.—Another sad, rainy month, but mild until the last two days.

HULL, PEARSON PARK.—Frequently cold and dull, with but 38·5 hours of sunshine, half of which occurred on 4 days. Occasional dense fog. The first heavy S fell on 30th, followed by sleet and H.

LLANFRECHFA GRANGE.—Free from much fog, but very damp. Mild, with *frost on 19th and 30th,* and mild nights until 29th. R much below the average.

HAVERFORDWEST.—Very cold from 15th to 20th, a storm system of considerable magnitude developing between 2 a.m. on 20th and 21st. The last two days were cold and dry. Duration of sunshine 62·2 hours.

ABERYSTWITH, GOGERDDAN.—A considerable amount of R, the heaviest being on 27th, when there were floods again. Two spells of sharp frost.

DOUGLAS, WOODVILLE.—Weather most unsettled, with absence of any defined type. Very stormy at times, with violent W. and N.W. gales on 20th, 21st and 25th. H on 3 days. Sharp frosts on 29th and 30th.

SCOTLAND.

CARGEN [DUMFRIES].—Although no heavy fall occurred on any single day, it was an exceptionally damp month, many days on which no R fell being moist and misty. A considerable quantity of the grain crop was still in the fields at the end, and much that had been "secured" was absolutely valueless.

LILLIESLEAF, RIDDELL.—The weather was variable, with a very heavy storm and some S near the end. Wind westerly throughout.

MULL, QUINISH.—Very mild and wet and singularly sunless up to the 29th, when S fell, followed by frost and sunshine.

COUPAR ANGUS.—R on 15 days, in all cases very sparingly, the total being two inches below the average. There was a great improvement in the weather, and a good potato crop. The temp. became very low during the last week.

MONTROSE, SUNNYSIDE ASYLUM.—A capital month, favourable for finishing the harvest and pitting potatoes.

ALFORD, LYNTURK MANSE.—Somewhat early S, a slight fall on the 21st and lasting from 24th more or less to the end.

DRUMNADROCHIT.—R ·56 in. above the average of 17 years. Notwithstanding the almost daily R, the farmers on higher lands secured crops in good condition except potatoes, which became frost-bound in the ground. Of the 63 days ending on 30th, ·01 in. of R, or more, fell on 56.

WATTEN, H.R.S.—Very changeable. Cloudy and wet, with a series of storms of wind and R; then frost and S, thaw and renewed S.

CASTLETOWN, THE CLETT.—The first 8 days were fairly dry, giving farmers some opportunity to finish cutting and partly secure their corn. Broken wet weather to 19th, with an occasional dry day and high winds. From the 19th to the end was very wet and cold with high winds, and on 25th a steady S storm set in, continuing to the end. Some grain still in the fields buried under S, and some still uncut. The potato crop is generally still in the ground.

IRELAND.

DARRYNANE ABBEY.—Mild, with some very fine days in the first half. Some S on 30th.

CORK, WELLESLEY TERRACE.—R 2·42 in. less than the average, and for the 11 months 14·35 in. over the average. The mean temp. was 41°·1, the lowest for 25 years. Gales on 21st and 27th, the latter after a fall of ·58 in. in 9 hours. First S on 30th.

MILTOWN MALBAY.—The last 5 days of the first week were calm, dry and sunny, and splendid for gathering the remainder of a bad harvest, but the remainder was damp and rainy, finishing with sharp frost and slight S.

DUBLIN, FITZWILLIAM SQUARE.—An average month as regards temp. and R. Frost and S showers in the last two days. Mean temp. 45°·4, or exactly the average. Duration of sunshine 98 hours. High winds on 8 days, attaining the force of a gale on 21st and 23rd. Foggy on 6 days.

COLLOONEY, MARKREE OBSERVATORY.—Very broken and stormy at times, with R. Temp. about the average. The amount of bright sunshine was very small as the weather was cloudy. A few fogs in the early part.

OMAGH, EDENFEL.—A typical November, with a good deal of weather that in another year, with an atmosphere and soil less saturated by previous R, would have been fine. It was dark, humid and mild, with practically no frost until the last few days.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1903.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	85·9	28	39·7	13	67·5	48·6	49·4	76	133·7	35·4	6·43	10	6·0
Malta	86·7	17	59·5	1	78·4	63·9	60·7	74	136·6	52·5	·08	1	2·5
Lagos, W. Africa	81·0	3, 4	69·0	5	83·8	75·0	73·9	83	134·0	69·0	21·62	21	...
Cape Town	72·3	7	38·8	10*a*	60·2	47·7	48·4	83	...	...	6·79	19	6·3
Durban, Natal	80·4	1	46·1	27	73·9	52·7	...	...	131·3	...	·70	5	2·0
Mauritius	79·6	2, 13	56·5	11	77·5	63·7	61·8	75	142·2	48·2	1·98	16	5·1
Calcutta	98·9	2	72·5	3	94·0	78·2	76·4	75	156·2	71·5	10·70	11	7·2
Bombay	93·1	12	74·8	23	87·6	79·4	77·5	82	135·7	73·4	19·75	19	6·7
Madras	103·1	27	74·3	14	96·8	79·7	73·8	71	143·7	73·7	1·46	7	5·4
Kodaikanal	72·3	6	52·0	19	66·4	54·7	52·2	79	152·1	40·2	5·29	11	7·2
Colombo, Ceylon	89·2	29	70·8	3	87·5	78·2	75·6	84	146·5	70·0	5·42	25	7·6
Hongkong	90·5	12	73·4	28	86·4	78·5	76·0	82	145·3	...	25·23	18	7·4
Melbourne	60·1	30	33·1	24	54·6	42·8	42·6	82	115·6	25·8	3·35	16	7·7
Adelaide	64·0	2	38·2	19*b*	58·6	44·9	45·4	81	124·3	31·6	3·87	18	7·2
Coolgardie	71·8	6	35·0	16	62·2	45·1	45·7	73	139·0	31·1	1·58	8	6·2
Sydney	64·9	23	38·4	26	59·7	47·6	42·0	75	96·0	30·0	1·74	13	4·3
Wellington	62·0	30	32·0	8	53·1	40·3	39·6	79	95·0	25·0	3·04	16	4·9
Auckland	62·0	12	40·5	26	57·4	48·1	44·3	74	120·0	38·0	3·20	21	6·3
Jamaica, Negril Point	91·8	29	69·6	11	87·6	74·5	73·4	75	...	...	2·65	7	...
Trinidad	96·0	1	61·0	4	75·1	73·7	72·3	79	167·0	62·0	5·42	15	...
Grenada	88·8	9	72·0	2	84·5	74·7	71·7	78	152·0	...	8·73	29	4·0
Toronto	87·6	30	44·3	19	71·1	52·5	52·6	74	104·0	39·4	3·34	15	6·3
St. John's, N.B.	75·0	23	41·8	5	65·3	49·2	...	...	...	...	3·13	12	7·1
Winnipeg	87·0	26	34·5	15	75·4	47·6	...	...	...	...	·49	8	4·5
Victoria, B.C.	87·8	8	42·3	3	66·6	51·4	...	...	...	...	·67	13	6·1
Dawson	89·5	19	34·5	7	71·5	46·1	...	...	...	...	·50	8	3·6

a and 22. *b* and 28.

MALTA.—Mean temp. of air 69°·6 or 2°·0 below, mean hourly velocity of wind 10·2 miles or 1·4 above, averages. Mean temp. of sea 73°·3.

Mauritius.—Mean temp. of air 1°·1, dew point 1°·0, and R ·07 in., above averages. Mean hourly velocity of wind 10·3 miles, or 0·9 below average; extremes, 28·7 on 26th and 1·7 on 3rd; prevailing direction E.S.E.

MADRAS.—Bright sunshine 126·3 hours, or 32·8 per cent. of possible.

KODAIKANAL.—Mean temp. of air 58°·7. Mean velocity of wind 337 miles per day. Bright sunshine 107·2 hours.

COLOMBO.—Mean temp. of air 81°·8 or 0°·8 above, of dew point 1°·4 above, and R 2·90 in. below, averages. Mean hourly velocity of wind 9·8 miles, prevailing direction S.W.

HONGKONG.—Mean temp. of air 82°·0. R 9·42 in. above average. Bright sunshine 151·6 hours. Mean hourly velocity of wind 11·7 miles, prevailing direction S.S.W.

Adelaide.—Mean temp. of air 51°·8 or 1°·6 below, and R ·98 in. above, the average. Very cloudy month, with humid weather and frequent rain in settled areas, but rains deficient inland.

Sydney.—Mean temp. of air 0°·7, humidity 4·8, and R 3·87 in. below, averages.

Wellington.—Mean temp. of air 2°·6 below, and R 2·06 in. below, averages.

Auckland.—Mean temp. of air slightly below average. R 1·50 in. below average of *35 years. Cloudy* and showery.

TRINIDAD.—R 2·90 in. below the 40 years' average.

SYMONS'S

METEOROLOGICAL MAGAZINE.

No. CCCCLVI.] JANUARY, 1904. VOL. XXXVIII.

THE RAINFALL OF 1903.

THE usual cumulative table of rainfall differences from the average of 1890-99 assumes this month the form of a summary of the rainfall of the year. The 51 stations included in it are not sufficient to allow us to calculate the difference of the rainfall of the country as a whole from the average, but it suffices to show that, speaking generally, the excess was greatest in England and Wales and least in Scotland and Ireland. It shows also that the British Isles were very wet from north to south and from east to west. The largest excesses were recorded at London, Hitchin and Hartley Wintney, where they averaged over 60 per cent.; but it must be remembered that in the south of England the ten years employed for an average in these pages was drier than the thirty years' average by nearly ten per cent. The north-west of Scotland also showed large excesses, more than 50 per cent. in several places, and there the average for the ten years used does not differ appreciably from the long period average.

In discussing the rainfall of the country on the basis of 62 stations with 30 years averages in a letter to *The Times* of January 11th, we pointed out that the excess of rainfall for England seemed to be about 28 per cent., for Wales (and this was due especially to the mountainous part of North Wales) 33 per cent., for Scotland 26 per cent., for Ireland 29 per cent., and for the British Isles 28 per cent. These, of course, are preliminary figures liable to correction. The heavy rainfall of the Thames basin, and especially of London, seems to be quite unprecedented, but taking a wider sweep we must recognise that the year was not so wet as 1872 or as 1852. There does not seem to be any recent year, with those exceptions, approaching 1903, unless 1877 may possibly have some claim to consideration. The driest areas relatively to the average, and probably the driest absolutely for the year, seem to have been in Norfolk and in a narrow strip of country running from south of Leicester through Lincolnshire to Hull; the excess there not exceeding ten per cent. of the thirty years' average.

Speaking generally, we may say that 1903 was wetter than any year since 1872, and was not previously excelled for wetness since 1852.

Rainfall of the year 1903, *showing excess on the average of the ten years* 1890–99.

Stations.	Diff. from Aver.	Per cent. of Aver	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	15·32	167	Arncliffe ...+	20·25	133	Braemar ...+	9·40	127
Tenterden .....+	6·03	123	Hull .....+	4·23	117	Aberdeen ...+	8·32	126
Hartl'yW'ntn'y+	13·94	156	Newcastle...+	8·56	133	Cawdor .....+	3·57	112
Hitchin .....+	14·31	162	Seathwaite +	31·89	124	Glencarron +	14·44	115
Winslow .....+	11·10	147	Cardiff .....+	15·23	139	Dunrobin ...+	6·22	120
Westley.....+	6·19	124	Haverf'dwest+	13·50	131	Darrynane +	4·40	109
Brundall.....+	4·45	118	Gogerddan +	16·54	137	Waterford +	11·32	129
Alderbury .....+	12·26	145	Llandudno +	7·95	126	Broadford..+	13·29	140
Ashburton .....+	16·61	133	Dumfries ...+	16·96	139	Carlow .....+	10·97	133
Polapit Tamar +	15·41	142	Lilliesleaf ...+	11·90	139	Dublin .....+	4·29	116
Stroud .....+	13·07	149	Colmonell ...+	9·14	121	Mullingar...+	11·70	132
Woolstaston ...+	14·61	150	Glasgow ...+	19·33	153	Ballinasloe +	10·30	128
Boston .....+	9·49	147	Inveraray ...+	16·47	123	Clifden .. ...+	7·70	110
Hesley Hall ...+	5·38	125	Islay .....+	11·21	124	Crossmolina +	12·69	124
Derby.....+	8·53	138	Mull .....+	12·96	123	Seaforde ...+	12·42	134
Bolton .....+	10·03	124	Loch Leven +	16·36	146	Londonderry+	5·56	113
Wetherby .....+	13·95	159	Dundee .....+	7·10	126	Omagh .....+	15·20	138

AN UNEXPECTED USE FOR SUNSHINE RECORDERS.

It is only a commonplace remark that some of the most important discoveries of science have been the unexpected results of investigations made with quite different objects in view. It is perhaps to descend from great things to small—and it is certainly without wishing to suggest that the "discovery" is likely to rank as more than an interesting one—to point out that something analogous to this has occurred in connection with the Campbell-Stokes sunshine recorder, since it has quite recently been found that that instrument, designed to record bright sunshine, is also capable of registering the presence in the air of substances likely to obstruct the passage of the sun's rays.

Our readers will no doubt remember the paper on the great dust fall of February 21st, 1903, which Dr. Mill read before the Royal Meteorological Society at its November meeting. From a large body of evidence it was shown that over a large part of the British Isles, and also over a considerable portion of the Continent, a great quantity of dust had been deposited, after having been borne on the wings of the wind over land and sea for vast distances. This evidence was obtained from various sources. In many instances the dust was found as a deposit in the rain water collected in rain *gauges*. In others it was seen on window-panes, upon which the

rain had beaten; and in others the fall had been sufficiently large to be seen upon the ground, or upon objects open to the sky, and sometimes without the agency of rain for its deposition. Amongst other sources of information were the cards which had been exposed in sunshine recorders, on many of which the red dust had left indelible marks, as well as specimens of the dust itself.

Since then similar evidence has been found of another dust fall which occurred on the 27th of November last, and which seems to have extended itself over a great part of England, but to have been specially well marked in the south-eastern districts. In this instance, as in the former, not only were the cards stained by the wetted dust, but unmistakeable specimens of the dust itself had been left attached to the cards. In both falls, however, cases were noticed in which those who removed the cards had tried to remove the stains also, evidently because it was thought to be "dirt" which had no business there; and the chief object of this note is to call the attention of sunshine observers to the fact that records of such dust falls may be expected, and will certainly be useful, and to get them to handle the cards at such times as it may be noticed carefully, and to record their appearance before the dust, or the stains of the dust if it has fallen in conjunction with rain, has been partially removed or obliterated by rubbing.

One noteworthy fact in connection with the records may be mentioned, namely that in nearly every instance, in both falls, it was found upon the *eastern* side of the card, as a result of the dust having been carried along by a *westerly* wind. During the severe gale of February 26th-27th, 1903, the sunshine card at Blackpool, although exposed on a stand on high ground a couple of miles back from the coast, was *thickly* encrusted over its eastern half with sand and salt brought from the shore by the westerly wind; and not only did a similar thing occur at other places on that coast, but traces of a similar deposit were also found on cards from a few places many miles to the eastward, a fact which proves that sand can travel through the air for considerable distances. In the case of the dust falls which Dr. Mill and Mr. Lempfert have discussed, a good deal of light has been thrown upon the general circulation of the air, which has proved to be extremely interesting and instructive when considered in conjunction with the views of Dr. W. N. Shaw, F.R.S., as to the actual motion of the air in a travelling storm. It is possible, and indeed probable, that with more precise observations of dust falls, and with more reliable continuous records of pressure, our knowledge respecting atmospheric circulation may be considerably extended and improved.

R. H. C.

ROYAL METEOROLOGICAL SOCIETY.

THE openiug meeting of this Society for the present session was held on Wednesday evening, November 18th, at the Institution of Civil Engineers, Great George Street, Westminster, Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

The following gentlemen were elected Fellows of the Society :— Mr. H. L. Attridge, Rev. D. C. Bates, Mr. C. Lowthian Bell, Mr. W. Cleeve Edwards, Assoc.M.Inst.C.E., Captain R. Ford, Dr. R. D. Fulton, Mr. T. M. Guest, Mr. R. T. A. Innes, F.R.A.S., Mr. T. N. Leslie, F.G.S., Captain C. H. Ley, R.E., Dr. J. D. Macdonogh, Dr. E. Mather, Mr. W. Morris, M.Inst.C.E., Mr. G. E. J. Rose, Captain W. R. Rowe, and Captain L. H. Tamplin.

Dr. H. R. Mill and Mr. R. G. K. Lempfert gave a Report on "The Great Dustfall of February, 1903, and its Origin."

Dr. Mill read extracts from many of the letters which he had received bearing on the enquiry, and exhibited maps showing the distribution of the dust, from which it appeared that the dust reported on February 21st or 22nd fell over nearly all parts of England and Wales to the south of a line drawn from Anglesey through Wrexham and Northampton to Ipswich, except in parts of northern Cornwall, Somerset, Wilts and Mid Wales. To the north of that line there was an apparently isolated fall in northern Norfolk, and at a few remotely isolated stations, at most of which the fall did not attract the attention of any observers, but is believed to have taken place, on account of distinct marks of yellow dust detected on the sunshine cards sent in to the Meteorological Office. The dust usually attracted attention either in the form of a dense yellow haze, like a London fog, or as a reddish yellow powder lying thickly on trees or roofs, or adhering to windows. In some instances it was noticed in the form of drops of muddy rain, in others the circumstance which struck the observer was the soapy appearance of the water in a rain gauge, a water butt, or, in one case at least, in an open leet carrying the water-supply of a town. The fall was often accompanied by temperatures considerably above the average and by remarkably low relative humidities. In order to ascertain whether the composition of the dust threw any light on its origin about fifty samples, including some from the Continent and some collected at sea, were submitted to the Geological Survey and examined by Dr. J. S. Flett.

Mr. Lempfert exhibited maps showing the meteorological conditions prevailing during the period when the dust appeared. With the help of these isobaric charts he endeavoured to trace the source from which the air was being supplied to north-west Europe on the morning of February 22nd. Trajectories of the air had been drawn from a number of points in a manner similar to that employed in Dr. W. N. Shaw's paper on the Storm of February 26-27, 1903. The trajectory which reached the southern part of England could be traced backwards in a south-westerly direction to the neighbourhood

of the Azores, but here it turned to the south, and finally to the south-east, and was carried back to the north-west coast of Africa on the morning of the 19th. He was, therefore, of opinion that there is reason to believe that the air which reached the southern half of England on the 22nd started from the north-west coast of Africa on the 19th, and he considered this afforded strong evidence of the African origin of the dust, and of its having travelled to north-west Europe by a path not very different from that indicated by the trajectories.

Dr. J. S. Flett said that the result of his examination of the specimens of the dust was to show that the bulk of each consisted of comparatively coarse particles of mineral and organic origin derived from the locality where it was collected. These coarser particles consequently presented a great variety of composition, some being mainly calcareous, others made up of sand or clay, in fact, just such local dust as might be expected to be mixed with the finer particles falling from the air. In addition to the coarser particles all the samples contained a very fine grained reddish clay, the particles of which were too minute to be satisfactorily determined mineralogically. This clay was certainly derived from some source beyond the British Isles, but it was not distinctive enough to afford much evidence as to its place of origin.

The President, Mr. R. H. Curtis, Mr. F. Druce, Mr. F. J. Brodie, and Mr. C. Harding took part in the discussion, and Dr. H. R. Mill and Mr. R. G. K. Lempfert replied.

The second monthly meeting of this Society for the present session was held on Wednesday evening, December 16th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, F.R.S.E., President, in the chair.

Mr. C. O. Baines, Mr. J. N. Beadles, Mr. R. Brown, Assoc.M.Inst.C.E. Mr. F. J. Finglah, Mr. V. Smith, Mr. J. H. Taylor, M.Inst.C.E., Mr. T. G. Taylor, Mr. T. J. Thomas, Assoc.M.Inst.C.E., and Mr. C. T. R. Wilson, F.R.S., were elected Fellows of the Society.

Mr. W. Marriott gave an account of the meteorological work of the late Mr. James Glaisher, F.R.S., who was the founder of the Society, in 1850, and who died on February 7th last at the advanced age of 93 years. Mr. Glaisher was appointed Superintendent of the Magnetic and Meteorological Department of the Royal Observatory, Greenwich, on its formation in 1840. He soon became interested in and conversant with all kinds of meteorological investigations, and through his instrumentality numerous meteorological stations were equipped in various parts of the country. He supplied quarterly the results from those stations to the Registrar General from 1847 up to March, 1902. He prepared various Tables of Corrections for the use of these observers, the principal of which were his "Hygrometrical Tables," which have passed through nine editions. He was a juror of the Great Exhibition of 1851, and as such he caused a

great stimulus to be given to the manufacture of reliable meteorological instruments. Mr. Glaisher was best known to the public by the twenty-eight balloon ascents which he made for scientific purposes in 1862-66 on behalf of a British Association Committee. Mr. Marriott illustrated his address with numerous lantern slides and also exhibited the instruments, used by Mr. Glaisher in his balloon ascents, which by the courtesy of his son, Dr. J. W. L. Glaisher, F.R.S., had recently come into the possession of the Royal Meteorological Society.

A paper by Mr. J. R. Sutton, M.A., on "Certain Relationships between the Diurnal Curves of Barometric Pressure and Vapour Tension at Kenilworth (Kimberley), South Africa," was, in the absence of the author, read by the Secretary. The author referred to the views of a number of leading meteorologists on the part played by "vapour tension" as a component of barometric pressure, and brought forward a series of observations at Kimberley designed to throw light on the still unsolved problem of the cause of the diurnal barometric wave. The paper elicited some discussion, in which Dr. W. N. Shaw and Mr. Dines took part.

Correspondence.

GREENWICH RAINFALL OF 1821 AND 1824.

To the Editor of Symons's Meteorological Magazine.

Will you kindly permit me to point out an error of some importance in your article on "The Unexampled London Rainfall of 1903." In that article (p. 181) the following values marked "doubtful records" are given for Greenwich Observatory for the years 1821 and 1824—viz., 34·5 in. and 36·3 in. These values are not correct, the amounts recorded in the Observatory Journals being 31·53 in. and 32·98 in. Dines, in his paper on the "Rainfall of the London District, 1813—1872," gives rainfall for 1821 as 31·69 in. and for 1824, 32·43 in. (*Quarterly Journal, Meteorological Society, 1873.*)

W. C. NASH.

Mycena Road, Westcombe Park, S.E.,
7th January, 1904.

[We think it right to publish this letter at once, so that it may appear in the same volume as the original statement; but the figure for 1824 quoted by Mr. Nash coincides with that observed by Mr. J. H. Belleville, at Park Row, Greenwich, and not, we understand, at the Observatory itself. We have a copy of a record for "Greenwich Observatory," giving the figures quoted in our article, but there is a note attached by Mr. G. Dines which seems to cast doubt upon it, hence the mark "doubtful." We shall look into the matter further at a less busy period of the year.—*Ed. S.M.M.*]

THE CLIMATE OF KODAIKÁNAL.

By C. Michie Smith.

The Kodaikánal Observatory is situated on the Palani Hills in South India, in about latitude 10° 14′ N. and longitude 77° 30′ E. The height of the barometer cistern above sea level is taken as 7,688 feet, but this may be in error by several feet. Observations of the barometer, wet and dry bulb thermometers, and of rainfall, were begun in May, 1899, and complete observations were begun in January, 1900, except for wind direction and force, which were not made in a satisfactory way till the completion of the anemometer tower early in 1902. As usual in India the thermometers are exposed in an open shed covered with six inches of thatch. The means are determined from Richard records standardised by four eye readings of the thermometers daily. It may be thought that the observations have continued for so short a time that the means cannot be taken to be of much value, and for this reason they are given only to the nearest degree. At the same time it may be noted that the differences between the several years are so small in the case of pressure and temperature that, I believe, the provisional means given below are very near the truth. As regards wind and rain, and perhaps sunshine, this is not the case, and though the means are given in the table they cannot be considered to be satisfactory.

The outstanding feature of the climate is, undoubtedly, the remarkable uniformity of the temperature throughout the year—the range of the mean monthly temperature being only 7° F. The extreme range from highest shade maximum to lowest shade minimum is 37°. In the shed, four feet above the ground, the temperature has never fallen below 39°, but on the grass outside it has fallen as low as 23°·4. Hoar frost is not uncommon in the early mornings from November to February, but this is largely an effect of evaporation. It is most intense on low-lying, damp ground, and on very dry mornings when the relative humidity (as calculated by the ordinary tables) may fall as low as 5 %.

Kodaikánal is, during the summer months, a fairly popular health resort. Most of the houses lie near the lake, which is some 800 feet below the Observatory, and are sheltered by hills and woods. The soil is mainly gravel, so that the ground dries quickly even after a heavy shower of rain. The most unpleasant part of the year is usually from the middle of October till towards the end of December, when heavy mist and rain may be expected at frequent intervals. The first three months of the year are usually very fine, but the station is then nearly deserted, since the heat of the plains has not yet driven people up to the hills. After that, though the mornings and evenings are usually fine, there are frequent showers in the afternoons. With its fine scenery and splendid climate Kodaikánal has probably a great future before it as a health resort, especially for persons of moderate means or for those who shun the excessive gaieties of stations like Simla and Ootacamund.

Mean Monthly and Annual Meteorological Averages (provisional) for Kodaikánal Observatory.

	BAROMETER.		DRY BULB THERMOMETER.				WET BULB.		Tension of Vapour / Relative Humidity.		Sun Max. in Vac.	Min. on Grass	WIND.			RAIN.		Clear Sky.	Bright Sunshine.
	Reduced to 32°.	Daily Range.	Mean	Max.	Min.	Range.	Mean	Min.	By Blandford's Tables.				Daily Velocity.	Mean Direction.		Amount	Days		
	in.	in.	°	°	°	°	°	°	in.	cents.	°	°	miles.	points.	points.	in.	No.	cents	hours.
Jan.....	22·853	0·071	54	63	47	16	47	41	0·261	63	120	38	368	6	E.N.E.	*4·12	5	67	238
Feb... ..	·878	·070	55	65	48	17	48	42	·271	61	129	39	292	6	E.N.E.	*2·20	4	60	202
March..	·867	·068	58	68	51	17	49	42	·255	53	134	43	346	6	E.N.E.	2·69	4	69	251
April ...	·833	·071	59	69	53	16	54	48	·358	70	138	46	260	5	N.E. by E.	4·99	10	46	202
May ...	·822	·068	60	69	55	14	55	51	·386	73	136	50	250	2	N.N.E.	4·36	11	42	194
June ...	·779	·057	58	66	54	12	54	50	·363	77	132	50	355	28	N.W.	3·54	12	29	144
July ...	·765	·056	57	63	52	11	53	49	·380	83	128	49	400	27	N.W.byW.	4·38	13	24	103
August..	·777	·063	57	64	53	11	54	50	·394	84	130	49	302	29	N.W.byN.	3·95	12	27	118
Sept. ...	·812	·071	57	64	52	11	56	50	·396	85	132	49	287	31	N. by W.	7·52	15	33	106
Oct.....	·827	·076	55	62	51	11	54	49	·386	86	127	47	252	4	N.E.	11·16	20	31	118
Nov. ...	·835	·070	54	61	49	12	52	47	·373	87	121	45	243	3	N.E. by N.	6·60	16	32	88
Dec. ...	·845	·074	54	62	48	14	49	44	·307	73	118	42	247	5	N.E. by E.	5·73	10	51	156
Annual ..	22·824	0·068	56	65	51	14	52	47	0·344	75	129	46	300	2	N.N.E.	61·24	132	43	1920
																5·10	11		160

* Rainfall certainly abnormally high.

Sun passes through zenith April 16th and August 26th.

Extreme Monthly Meteorological Results at Kodaikánal, 1899-1902.

	Barometer.		Dry Bulb Thermometer.		Wet Bulb.	Humidity	Sun Thermom.	Grass Thermom.	Wind. miles per day.		Rain.
	Highest.	Lowest.	Highest.	Lowest.	Lowest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Greatest Fall.
	In.	In.	°	°	°	%	°	°			In.
Jan.....	22·953	22·751	71	39	30	5	147	27	569	105	4·08
Feb.	·989	·781	71	43	33	5	147	29	544	113	1·23
Mar.....	·994	·782	75	45	35	6	154	32	562	113	3·74
April ...	·921	·730	74	49	40	16	155	37	882	102	1·59
May	·955	·733	76	51	43	25	150	41	441	88	1·53
June....	·905	·654	72	50	41	36	157	43	790	80	1·67
July	·886	·660	69	49	41	5	148	42	722	82	1·58
Aug.....	·865	·656	69	49	42	40	157	39	758	88	2·16
Sept. ...	·927	·710	68	48	42	36	151	42	682	77	2·66
Oct.....	·960	·682	68	44	37	37	148	37	720	55	1·81
Nov.....	·948	·720	67	39	33	13	149	28	554	72	2·25
Dec.	·944	·730	70	42	33	7	141	23	700	52	3·21

METEOROLOGICAL NEWS AND NOTES.

THE DAILY WEATHER REPORT for January 1st achieved a record in up to date information by publishing the annual totals of rainfall for 1903 at all the telegraphic reporting stations on the very day on which the last readings of the gauges were taken.

THE SCOTTISH ANTARCTIC EXPEDITION, after cruising in high latitudes in Weddell Sea and carrying out important oceanographical investigations, wintered in the South Orkneys, where Mr. Mossman remained behind while the *Scotia* went north to the Falklands and Buenos Aires to obtain supplies and communicate with home. Mr. Mossman, writing from the South Orkneys, informs us that he has obtained very interesting meteorological observations, a report of which we hope soon to receive. It is gratifying to see from the daily press that Mr. Bruce, the leader of the expedition, has obtained additional funds, which justify him in returning to Antarctic waters before the close of the present summer.

THE SWEDISH ANTARCTIC EXPEDITION, under Dr. Otto Nordenskiöld, spent the southern winter of 1903 in the exploration of the Antarctic Archipelagoes south of South America. The main party wintered on Seymour Island and experienced terrible weather, an unceasing succession of gales with very low temperatures. Their ship, the *Antarctic*, was crushed in the ice and lost, and the expedition was rescued by the very successful voyage of a vessel equipped by the Argentine Government and commanded by an Argentine naval officer.

A METEOROLOGICAL CHRISTMAS CARD sent to us by an esteemed correspondent succeeded in being both artistic and apposite. It represents a person closing an umbrella marked "1903," and the legend runs—

"We bid you farewell without much regret;
You'd have been a fine year if you hadn't been wet."

THE TEMPERATURE OF 1903 IN LONDON.

The following table gives a summary of the mean and extreme shade temperatures at Camden Square during the past year as compared with the average of 45 years.

Mean and Extreme Shade Temperature in 1903 *at Camden Square.*

	Mean Temp.	Diff. from Average	Mean Max.	Diff from Average	Mean Min.	Diff. from Average	Absolute Max.	Absolute Min.
	°	°	°	°	°	°	°	°
January	40·8	+2·7	45·2	+2·2	36·0	+2·7	53·8	22·1
February	45·1	+5·3	50·8	+5·3	40·0	+5·3	59·0	25·7
March	46·4	+4·3	53·9	+3·7	39·5	+4·0	67·9	29·9
April	45·2	−2·9	53·6	−4·5	37·1	−2·6	61·1	27·8
May	55·0	+1·0	65·1	+0·4	45·8	+1·4	80·9	34·9
June	57·6	−2·8	67·5	−3·8	48·6	−2·3	85·9	39·7
July	63·2	−0·1	73·1	−1·0	54·5	−0·5	87·2	45·2
August	60·7	−1·4	70·1	−2·5	52·4	−0·9	80·6	45·4
September	58·4	+0·7	67·6	+0·3	50·8	+1·1	83·7	38·1
October	53·1	+3·3	59·1	+1·6	47·8	+4·5	67·4	36·0
November	44·8	+1·8	50·2	+1·5	39·7	+2·0	57·2	29.9
December	39·0	−0·2	42·6	−1·4	35·5	−1·1	52·3	26·1
Year	50·8	+1·0	58·2	+0·1	44·0	+1·4	87·2	22·1

The most notable point is the extremely mild character of the year as a whole. This seems to be chiefly the result of high minima during the winter months, although in February and March, relatively the warmest months of the year, high maxima were almost equally prominent. The first three months all showed temperatures exceeding the average to an extraordinary extent, but this was in some measure balanced by cold weather in April, June and August. The summer was, as a whole, cold, June in particular being exceedingly unseasonable in this respect. A return to milder conditions in the autumn and the almost entire absence of frost until December, brought the mean temp. for the year to 50°·8, a degree above the average, and a figure not often reached in London.

REVIEWS.

Knowledge Diary and Scientific Handbook for 1904. London: *Knowledge* Office, 1903. Size, 9½ × 6. Pp. (text) 108.

A CONVENIENTLY arranged diary for the desk, with letterpress of interest to scientific amateurs.

The Production and Prediction of Magnetic and other Storms. By HUGH CLEMENTS. London: Wm. Hutchinson & Co. 1903. Size, 7½ × 5. Pp. 16. Price 1s.

How to Predict the Weather, Winds, and Magnetic Storms and Sunspots, by HUGH CLEMENTS. (No publisher's name). 1904. Size 7½ × 5, pp. 16 + 26. Price 1s.

WE are unable to make anything of these pamphlets. Such of our readers as are interested in meteorological paradoxes may like to read the assertions they contain; but the misprints often render the arguments obscure. The assertion is very plainly made that the author can forecast the weather from astronomical considerations; but, unfortunately, he has not succeeded in making the method of so doing intelligible to a reader of ordinary scientific education.

Hints to Meteorological Observers in Tropical Africa, with Instructions for taking Observations and Notes on Methods of recording Lake Levels. Published by the Authority of the Meteorological Council. London: H.M. Stationery Office, 1902. Size, 10 × 6. Pp. 16. *Plate.* Price 9d.

A REVISED edition of the "Hints" published by the British Association Committee on the climate of Tropical Africa, with the addition of notes on lake levels supplied by the Admiralty. We congratulate the Meteorological Office on interesting the Hydrographic Office in African fresh water lakes, a task which has frequently been attempted in vain for home waters. We note with interest that in his preface, dated November, 1902, Dr. Shaw states that the Meteorological Council have in view the publication of meteorological observations from the outlying parts of the British Empire. On a small scale we have published such reports in this Magazine for 23 years.

The Meteorological Office has also issued a list of 62 Colonial and Foreign Returns received by them in MS., mainly from tropical Africa and the islands of the Atlantic Ocean. We are surprised that the Pacific Islands are not better represented, as we believe observations are taken at a good many islands occupied by British firms engaged in the copra industry. A list of printed records follows which cannot fail to be useful. We note as a trifling error the omission of "*'s Meteorological*" in the title of this Magazine, which shrivels into "*Symons' Magazine.*"

RAINFALL AND TEMPERATURE, DECEMBER, 1903.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which '01 or more fell.	TEMPERATURE. Max. Deg.	Date	Min. Deg.	Date.	No. Nights below 32° In shade.
			inches.	inches.	in.							
I.	ENGLAND.	London (Camden Square) ...	1·30	— ·63	·34	10	12	52·3	9	26·1	31	9
II.		Tenterden	1·75	— ·48	·46	7	15	51·5	9	22·0	31	10
,,		Hartley Wintney	2·68	+ ·54	·66	11	11	52·0	9, 10	25·0	30	10
III.		Hitchin	1·90	— ·04	·63	10	15	50·0	9	22·0	30	13
,,		Winslow (Addington)	1·20	— ·81	·35	12	13	50·0	9, 22	24·0	3, 31	10
IV.		Bury St. Edmunds (Westley)	1·23	— ·88	·30	10	10	49·0	9	24·5	29	...
,,		Norwich (Brundall)	1·28	— ·80	·26	10	15	49·0	14	26·0	5	9
V.		Winterborne Steepleton	5·06	...	1·37	12	18	51·1	8	20·0	3	12
,,		Torquay	5·20	...	1·14	12	20	53·0	7	29·9	1	4
,,		Polapit Tamar [Launceston]..	4·64	+ ·98	·74	12	21	51·3	8	20·9	2	12
VI.		Stroud (Upfield)	1·66	— ·57	·47	12	14	...	...	25·0	2, 31	11
,,		Church Stretton (Woolstaston)	2·68	+ ·13	·56	12	20	47·5	22	22·0	30	15
,,		Worcester (Diglis Lock)	1·15	— ·77	·20	8	16	...	...	...	...	...
VII.		Boston	1·11	— ·44	·25	8	7	48·0	22	24·0	2	13
,,		Hesley Hall [Tickhill].....	·88	— ·98	·17	7	17	49·0	22	20·0	30	15
,,		Derby (Midland Railway).....	1·23	— ·63	·40	8	15	49·0	9, 22	26·0	5*b*	12
VIII.		Bolton (The Park).....	2·07	— 1·61	·62	3	16	48·4	22	25·1	2	8
IX.		Wetherby (Ribston Hall) ...	1·37	— ·55	·26	7	18	...	...	...	...	...
,,		Arncliffe Vicarage.....	4·96	— 1·50	1·10	3	21	...	...	...	...	...
,,		Hull (Pearson Park).	·80	— 1·40	·19	7	12	49·0	22	26·0	1	11
X.		Newcastle (Town Moor)	1·94	— ·49	·40	24	21	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	12·46	— 2·47	4·13	3	17	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·75	+ ·66	·75	12	20	...	...	...	...	...
,,		Haverfordwest	4·84	+ ·13	·61	3	20	52·7	22	22·0	2	10
,,		Aberystwith (Gogerddan) ...	3·23	— 1·32	·58	3	16	52·0	21	19·0	1	22
,,		Llandudno.....	2·71	— ·19	·90	3	18	56·2	22	27·5	30	4
XII.	SCOTLAND.	Cargen [Dumfries]	3·74	— ·98	·46	9	17	52·0	22	21·0	2, 30	16
XIII.		Edinburgh (Royal Observatory)	1·08	...	·20	3, 13	16	53·1	22	25·6	1	11
XIV.		Colmonell	4·90	+ ·05	·85	6	17	56·0	9	18·0	29	14
XV.		Tighnabruaich	4·93	...	·82	21	18	46·0	21*a*	27·0	1, 30	12
,,		Mull (Quinish).....	5·70	— ·55	1·49	2	16	...	...	...	...	...
XVI.		Loch Leven Sluices	3·27	— ·38	·50	3	17	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·50	— ·31	·60	13	22	53·0	22	23·0	30	12
XVII.		Braemar	2·91	— ·10	·79	22	19	47·8	22	13·8	2	24
,,		Aberdeen (Cranford)	2·81	— ·17	·74	7	24	50·0	22	19·0	1*c*	18
,,		Cawdor (Budgate)	·63	— 1·98	·12	1, 11	10	..	...	...	...	...
XVIII		Strathconan (Dalbreac)	1·09	— 4·86	...	...	...	...	...	...	...	...
,,		Glencarron Lodge.....	4·37	— 6·06	1·73	2	16	...	...	...	...	...
XIX.		Dunrobin	1·42	— 2·04	·40	2	12	47·0	21*a*	24·5	30	17
,,		Castletown.....	2·26	...	·48	2	21	48·0	23	22·0	30*d*	19
XX.	IRELAND.	Darrynane Abbey.....	3·66	— 1·67	·42	6	24	...	...	29·0	2	...
,,		Waterford (Brook Lodge) ...	5·87	+ 2·00	·83	14	23	52·0	21	24·0	5	13
,,		Broadford (Hurdlestown) ...	5·28	+ 2·02	·65	11	20	48·0	9	22·0	1	11
XXI.		Carlow (Browne's Hill)	2·99	— ·39	·44	22	18	...	...	..	...	...
,,		Dublin (Fitz William Square)	1·59	— ·76	·29	12	16	55·8	21	27·1	2	8
XXII.		Ballinasloe	3·36	— ·23	·72	7	21	61·0	3	21·0	30	22
,,		Clifden (Kylemore)	8·09	— ·13	1·33	21	17	...	...	...	...	...
XXIII		Seaforde.....	4·48	+ 1·05	·96	6	19	48·0	21*a*	25·0	1	14
,,		Londonderry (Creggan Res.).	2·69	— 1·43	·61	7	22	...	...	...	...	...
,,		*Omagh* (Edenfel)	4·24	+ ·30	·54	6	21	51·0	21	13·0	1	16

+ Shows that the fall was above the average ; — that it was below it.
a and 22. *b* and 6, 29. c and 2, 5. d and 31.

SUPPLEMENTARY RAINFALL, DECEMBER, 1903.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Harrow Weald	2·06	XI.	Llandefaelog-fach.....	...
II.	Dorking, Abinger Hall .	3·13	,,	New Radnor, Ednol.....	4·46
,,	Sheppey, Leysdown	1·03	,,	Rhayader, Nantgwillt ...	6·44
,,	Hailsham	2·08	,,	Lake Vyrnwy	5·70
,,	Crowborough.....	2·84	,,	Ruthin, Plâs Dràw	2·59
,,	Ryde, Beldornie Tower..	2·47	,,	Criccieth, Talarvor	3·83
,,	Bournemouth, Kempsey	2·71	,,	I. of Anglesey, Lligwy..	4·94
,,	Emsworth, Redlands ...	2·33	,,	Douglas, Woodville.....	4·58
,,	Alton, Ashdell	3·77	XII.	Stoneykirk, Ardwell Ho.	3·09
,,	Newbury, Welford Park	2·05	,,	Dalry, Old Garroch	6·86
III.	Oxford, Magdalen Coll..	1·02	,,	Monaive, Maxwelton Ho.	4·73
,,	Banbury, Bloxham	1·50	,,	Lilliesleaf, Riddell	1·83
,,	Pitsford, Sedgebrook ...	1·10	XIII.	N. Esk Res. [Penicuick]	1·80
,,	Huntingdon, Brampton.	1·31	XIV.	Dalry, Blair	...
,,	Wisbech, Bank House...	·88	,,	Glasgow, Queen's Park..	3·20
IV.	Southend	1·12	XV.	Inveraray, Newtown ...	6·49
,,	Colchester, Lexden	1·20	,,	Ballachulish, Ardsheal...	7·52
,,	Saffron Waldon, Newport	1·33	,,	Campbeltown, Redknowe	5·46
,,	Rendlesham Hall	1·06	,,	Islay, Eallabus..... ...	4·41
,,	Swaffham	1·14	XVI.	Dollar.....	2·58
V.	Salisbury, Alderbury ...	3·30	,,	Balquhidder, Stronvar...	8·06
,,	Bishop's Cannings	2·34	,,	Coupar Angus Station...	2·81
,,	Ashburton, Druid House	7·18	,,	Blair Atholl	...
,,	Okehampton, Oaklands.	7·35	,,	Montrose, Sunnyside ...	3·20
,,	Hartland Abbey	4·43	XVII.	Alford, Lynturk Manse..	2·89
,,	Lynmouth, Rock House	6·18	,,	Keith H.R.S.....	1·48
,,	Probus, Lamellyn	6·95	XVIII.	Fearn, Lower Pitkerrie..	1·21
,,	Wellington, The Avenue	4·19	,,	S. Uist, Askernish	4·41
,,	North Cadbury Rectory	3·30	,,	Invergarry.....	4·80
VI.	Clifton, Pembroke Road	3·13	,,	Aviemore, Alvey Manse.	·40
,,	Ross, The Graig	2·11	,,	Loch Ness, Drumnadrochit	1·26
,,	Shifnal, Hatton Grange	1·86	XIX.	Invershin	1·53
,,	Wem Rectory	1·64	,,	Bettyhill	1·22
,,	Cheadle, The Heath Ho.	1·93	,,	Watten H.R.S.....	1·55
,,	Coventry, Kingswood ...	1·45	XX.	Cork, Wellesley Terrace	4·67
VII.	Market Overton	1·31	,,	Killarney, District Asyl.	5·11
,,	Grantham, Stainby	·82	,,	Glenam [Clonmel]	5·63
,,	Horncastle, Bucknall ...	·88	,,	Ballingarry, Hazelfort...	3·07
,,	Worksop, Hodsock Priory	·93	,,	Miltown Malbay	6·51
VIII.	Neston, Hinderton	1·56	XXI.	Gorey, Courtown House	4·26
,,	Southport, Hesketh Park	2·98	,,	Moynalty, Westland ...	3·36
,,	Chatburn, Middlewood.	3·18	,,	Athlone, Twyford	2·70
,,	Duddon Val., Seathwaite Vic.	7·77	,,	Mullingar, Belvedere ...	2·57
IX.	Langsett Moor, Up. Midhope	2·71	XXII.	Woodlawn	3·54
,,	Baldersby	1·29	,,	Westport, Murrisk Abbey	4·54
,,	Scalby, Silverdale	1·50	,,	Crossmolina, Enniscoe ..	5·47
,,	Ingleby Greenhow Vic..	1·32	,,	Collooney, Markree Obs.	3·22
,,	Middleton, Mickleton ...	1·83	XXIII.	Enniskillen, Portora ...	3·22
X.	Beltingham	1·87	,,	Warrenpoint.....	3·93
,,	Bamburgh	2·32	,,	Banbridge, Milltown ...	2·26
,,	Keswick, The Bank.....	4·53	,,	Belfast, Springfield	3·07
,,	Melmerby Rectory	3·00	,,	Bushmills, Dundarave..	2·42
XI.	Llanfrechfa Grange	3·95	,,	Stewartstown	3·47
,,	Treherbert, Tyn-y-waun	8·81	,,	Killybegs	4·16
,,	Castle *Malgwyn*	3·91	,,	Horn Head	3·52

METEOROLOGICAL NOTES ON DECEMBER, 1903.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm R for Rain; H for Hail; S for Snow.

ENGLAND.

LONDON, CAMDEN SQUARE.—Extraordinarily sunless and gloomy throughout. There was little frost except during the first week and the last few days. The R was comparatively slight, and almost all fell in the earlier part of the month. Mean temp. 39°·0, or 0°·2 below the average.

TENTERDEN.—Cold at the beginning and end, and showery in the second week. The rest of the month was generally dull and fairly dry. Duration of sunshine 32 hours; 14 sunless days.

CROWBOROUGH.—Cold and dull with several misty days. Frost on first six and last seven days, with a partial thaw on the 4th. Light S on 25th, 26th and 27th. Mean temp. 36°·8. Wind chiefly E. and N.

HARTLEY WINTNEY.—The first 15 days were wet and cold, and the following fortnight warmer and more genial with slight fog. Snap of frost and biting E. winds in the last week. Ozone was registered on 14 days with a mean of 3·1.

WINSLOW, ADDINGTON.—Dull and dark. Sharp frost on 2nd and 3rd, and again at the end. Dense fog on 5th and 17th. The meadows were covered with water on 13th.

PITSFORD, SEDGEBROOK.—Wet, dull and uncomfortable, although the R was 1·02 in. below the average of 10 years. Fog on 20th, and S on 25th. Mean temp. 36°·9.

COLCHESTER, LEXDEN.—Almost sunless and very dry, except from the 7th to 12th. The first and last weeks were cold.

BURY ST. EDMUNDS, WESTLEY.—A dull dry month, without severe frost. On 6th there was a very heavy rime frost, which was black on the points of the crystals, and when melted showed a deposit of soot. It probably came from the Midland counties. This extended for miles, and looked like ink and water when the thaw came.

BRUNDALL.—Much cloud, mist and gloom. Mean temp. 0°·7 below the average, and range of temp. smaller than usual, there being no very mild days and no exceptionally cold nights.

WINTERBOURNE STEEPLETON.—R rather less than the average of 10 years. Mean temp. 39°·1, or 2°·2 below the average.

TORQUAY, CARY GREEN.—R 1·35 in. above the average. Duration of sunshine 44·6 hours, being 9·3 hours below the average. Mean temp. 43°·0, or 0°·5 below the average. Mean amount of ozone 3·8.

OKEHAMPTON, OAKLANDS.—A wet and mild month, with the last week dry and frosty.

WELLINGTON, THE AVENUE.—The month opened cold, then followed a wet and fairly mild period until the 24th, the last few days being very cold, R about the normal.

NORTH CADBURY.—Very cloudy and very damp. Unusually quiet, though rough on 3rd and 12th. Most of the R fell between the 7th and 13th, 1·76 in. falling between 9 a.m. on 12th and about 3 p.m. on 13th. Mean temp. a little below the normal.

CLIFTON, PEMBROKE ROAD.—The first two days were fine with sharp frost; then R nearly every day till 17th. The remainder was dull and gloomy, with E. winds, and the last few days very cold. R ·25 in. under the average.

ROSS, THE GRAIG.—The first 7 days were very cold; then scarcely any frost till 27th, when there was sharp frost and bleak E. winds to the end. The R was considerably below the average, and almost all fell from 8th to 17th. The sky was overcast, or nearly so, for no less than 22 days, and from 15th to 29th was hardly seen. Mean temp. below the average.

WEM, THE RECTORY.—Very dark and gloomy. Not very cold until E. wind *and frost set in on 28th.*

BOLTON, THE PARK.—Slight R, but very little sunshine, the total duration being only 3·2 hours, or 12·2 hours below the average. The temp. was low to the 3rd, milder from 8th to 27th, and cold from 29th to the close.

SEATHWAITE VICARAGE.—Mild and almost continuously wet till the third week, when frost prevailed to the close with keen N.E. wind.

HULL, PEARSON PARK.—A dull and depressing month, exceptionally dry, the R being the lowest December record since 1885. A great amount of cloud and frequently fog or mist. On the 1st 3·2 hours' sunshine were recorded, and none afterwards.

WALES AND THE ISLANDS.

LLANFRECHFA GRANGE.—Very dark, with thick damp fog. Temp. low till 6th, then much warmer till 27th. when frost set in with cold N.E. winds.

HAVERFORDWEST.—Commenced with cold sharp weather, especially for the first three days. The cold lasted until the 7th, after which R fell constantly more or less till 25th. No R in the last 6 days, but an increasingly severe frost.

ABERYSTWITH, GOGERDDAN.—The early part was rather wet, with cold winds and cold nights. Very little sun throughout, and a little fog.

DOUGLAS, WOODVILLE.—Generally mild, with strong winds, and almost daily R till 23rd. The remainder was fine and dry, with some slight frost. Bitterly cold N.E. winds from 27th to 31st.

SCOTLAND.

LILLIESLEAF, RIDDELL.—The month was day after day just the same—dull, calm, foggy and dark, with occasional light showers. The temp. for the most part was just round about freezing point, but rather higher at the beginning. There was practically no S.

COUPAR ANGUS.—Practically normal R, and persistent wet days. Mean temp. 34°·0, or 0°·6 below the average. The month began and closed cold.

ABERDEEN, CRANFORD.—S and hard frost in the first week. R more or less every day for the last three weeks, with light winds and overcast sky.

DRUMNADROCHIT.—R 2·19 in. below the average of 17 years.

CASTLETOWN, THE CLETT.—Very changeable, sometimes cold and dry, sometimes sharp and keen frosts, and the latter part especsally dry, clear and frosty. The greater part of the potato crop was still in the ground, and in some cases there was corn still uncut on 15th.

IRELAND.

CORK, WELLESLEY TERRACE.—R ·22 in. over the average. Mean temp. 5°·3 over the average. Gale from S. on 21st.

HURDLESTOWN.—A wet month till Christmas. Then dry frost with cold E. wind.

MILTOWN MALBAY.—Cold, rainy and boisterous for nearly all the first three weeks. The last week was frosty and dry, with overcast sky and strong icy cold wind from S.E.

DUBLIN, FITZWILLIAM SQUARE.—Cold spells of considerable intensity at the beginning and end, separated by a wave of warmth, which culminated in temperatures of 55°·8 and 55°·7 on 21st and 22nd. R was frequent, but deficient in amount. Mean temp. 40°·9, or 0°·8 below the average. High winds on 9 days, attaining the force of a gale on three.

MARKREE OBSERVATORY—The first part of the month was very wet, with strong or fresh winds from S. or S.W., a few gales and 5 or 6 days with fogs. The end turned cold, with gloomy and dull days. Bright sunshine small, the total being only 32·7 hours.

OMAGH, EDENFEL.—The month opened with N.E. wind and frost; but with a change of wind to S.W. sharp frost never recurred, although polar winds were not infrequent. On the whole the mean temp. was rather below, and the rainfall again above the average, resulting in a month of general rawness, without any striking characteristic.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1903.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	87·2	10	45·2	8	73·1	54·5	53·4	71	128·1	40·4	5·20	13	6·1
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagos, W. Africa	88·0	3	69·0	20	81·8	73·8	72·4	83	141·0	68·0	8·75	14	6·5
Cape Town	73·6	8	37·7	1, 25	61·2	45·9	47·2	80	...	...	2·49	14	5·4
Durban, Natal	80·3	14	47·4	2	72·4	54·1	...	...	126·3	...	1·16	8	3·9
Mauritius	79·4	1	55·1	13	76·4	61·5	58·7	71	135·5	47·8	1·51	16	5·3
Calcutta	94·1	5	75·6	11	90·7	79·4	78·4	83	158·5	74·8	6·35	15	7·7
Bombay	88·0	7	75·1	17	84·2	77·7	77·2	88	137·5	74·2	24·82	29	9·2
Madras	99·1	3	74·4	8	94·0	78·2	72·8	72	141·4	71·7	3·82	19	7·4
Kodaikanal	67·1	4	51·7	25	61·7	53·2	51·8	85	141·6	46·2	5·42	16	8·5
Colombo, Ceylon	89·4	8	73·3	13	87·6	77·4	74·6	82	145·2	70·0	5·02	14	6·8
Hongkong	92·4	31	73·8	18	86·2	78·1	76·5	84	147·5	...	11·16	21	7·0
Melbourne	68·2	1	28·4	11	55·6	41·3	41·3	80	121·2	20·5	1·14	13	6·7
Adelaide	65·0	22	32·2	11	57·7	44·2	43·6	79	118·0	27·5	3·47	16	6·4
Coolgardie	66·2	20	35·8	8	57·5	41·3	41·2	73	131·5	34·1	1·29	8	6·3
Sydney	68·0	1	41·9	8	57·5	46·7	41·0	76	93·8	29·8	5·34	15	5·8
Wellington	60·0	4, 8	34·0	26	52·0	45·3	40·6	79	95·0	25·0	7·48	20	6·5
Auckland	61·5	13	34·0	16	56·0	46·1	43·2	75	120·0	32·0	3·46	20	5·5
Jamaica, Negril Point	91·8	9	69·4	18	88·0	73·8	72·6	75	...	...	6·99	17	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	85·4	31	71·6	16	83·4	74·3	72·1	80	144·2	...	10·00	29	4·8
Toronto	91·5	8	46·9	15	79·1	59·2	59·8	74	110·7	43·2	4·34	12	4·9
St. John's, N.B.	80·0	2	48·2	27	68·0	53·8	...	...	...	...	2·31	17	7·4
Winnipeg	93·8	23	35·5	31	77·8	52·9	...	...	...	...	3·05	12	5·4
Victoria, B.C.	75·1	20	47·0	15	64·5	51·9	...	...	...	...	·46	6	4·4
Dawson	85·5	26	38·8	23	73·3	47·5	...	...	...	...	1·11	7	4·0

Mauritius.—Mean temp. of air 0°·5 above, dew point 1°·1 and R ·71 in., below averages. Mean hourly velocity of wind 10·7 miles, or 1·1 below average; extremes, 31·9 on 21st and 1·8 on 20th; prevailing direction E.S.E.

MADRAS.—R normal, T88 on 3 days, T on 9 other days and distant L on 5 other days. Bright sunshine 99·6 hours, or 25·2 per cent. of possible.

KODAIKANAL.—Mean temp. of air 56°·1. Mean velocity of wind 618 miles per day. Bright sunshine 73·9 hours.

COLOMBO.—Mean temp. of air 81°·5 or 0°·9 above, of dew point 1°·1 above, and R ·56 in. above averages. Mean hourly velocity of wind 8·5 miles, prevailing direction S.W.

HONGKONG.—Mean temp. of air 81°·7. R 4·82 in. below average. Bright sunshine 208·1 hours. Mean hourly velocity of wind 11·4 miles, prevailing direction E. by S.

Adelaide.—Mean temp. of air 0°·5 below normal. R ·95 in. above 46 years' average.

Sydney.—Mean temp. of air 0°·2 below, humidity 1·0 below, and R ·74 in. above, averages.

Wellington.—Cold and disagreeable, foggy towards the end. Mean temp. of air 0°·2 below, and R 1·14 in. above, averages; prevailing wind N.W.

Auckland.—A mild July. Total R 1·25 in. under the average of 35 years.

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CONTENTS

The sternness of the external aspect of this Magazine is said to have had a repellant effect on chance readers, and with the commencement of the Fortieth volume it has been decided to remove that reproach from the cover, in the hope, however, that it will not be transferred to the contents. The central part of the design is the restoration of a building suggestive by its appearance, its purpose, and its fate, of the Tower of the Winds at Athens . . . . .

DESIGN FOR COVER, DRAWN BY M. J. DAWSON.

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Symons's Meteorological Magazine.

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OUR NEW VOLUME.

With this number commences the thirty-ninth volume of *Symons's Meteorological Magazine*, and the fourth under its present editorship. It has been our aim to maintain the interest and utility of the Magazine, though when we turn back to the earlier volumes, when each issue rang with the clash of arms of eager controversialists, we feel that the interest has often been allowed to flag. Such a state of things is not as it should be, and we trust that we are not in error in our belief that the twentieth century is about to witness a rapid advance in meteorological science. By the early reports of the meetings of the Royal Meteorological Society, the Scottish Meteorological Society, and the Cosmical Physics Section of the British Association, our readers are kept aware of all that is passing in the meteorological life of these islands, and it is only want of space, not want of will on our part, that prevents the survey from being world-wide. This year we propose, though we do not promise, to maintain the size of the magazine at twenty pages, and we have several articles of special interest in contemplation, as to which it will be safer to abstain from prediction until the promises on which we depend are in course of fulfilment.

The increase in the attention bestowed on matters meteorological during the recent heavy rains promises to lead to permanent results by increasing the number of observers, and it has had a marked effect in accelerating the promptitude with which the returns for *British Rainfall* have come in. It has long been characteristic of the British Rainfall Organization that all classes worked together to advance this little corner of science without distinction of person. It would be difficult to say off-hand whether Clergymen, Doctors, Engineers, Farmers, or Gardeners (the order is alphabetical) are doing most, but all are doing much. The Prime Minister has expressly authorised his gardener at Whittingehame to send in returns of rainfall, and many members of both Houses of Parliament take a practical interest in the work.

His Majesty the King has recently honoured the Rainfall Organization by accepting with a gracious message of thanks a copy of the

various publications, and he has been pleased to direct that returns from the rain gauges in all the Royal Gardens shall be sent in regularly for insertion in *British Rainfall*. The record from Windsor has long graced the pages; those from Sandringham and Balmoral will appear in the new volume of *British Rainfall*, and that at Buckingham Palace will fill up a gap in the rain returns of London.

Pleasing as it is to be encouraged by the countenance of those in the highest places, we do not forget that one of our most faithful and valued correspondents is a railway porter, observing not by the orders of his superiors but out of love for the work, and that many others earn their bread by the hardest toil. Our hope is to to do the best we can in discussing the records with which all the observers entrust us.

ATMOSPHERIC PRESSURE AS A FACTOR OF CLIMATE.

By L. Bonacina.

It is only by treating meteorological phenomena as the product of so many climatic factors that we are enabled to afford a satisfactory explanation of the atmospheric conditions of any portion of the Earth's surface.

We propose in this article to resolve climate, a term which we may define to be the average state of the weather over a given area, into its constituent factors, so that if from some remote or little-known land sufficient geographical data were received, we should be able to synthesize, as it were, its theoretical climate, which would bear a very close resemblance to its actual one. By adopting such a method of analysis, the fact, for instance, that the mean annual temperature of London is 49° F. becomes vested with a real interest;* for if we knew nothing about the climate of London we could from the possession of certain geographical and geological data relating to the city, infer that the climatic conditions were those of the colder portion of the temperate zone with an approximate mean annual temperature of 50° F.

The chief factors which are involved in the formation of the climate of any locality may be classified as follows:—(*a*) latitude of the locality, (*b*) its altitude, (*c*) physical features, that is whether it is composed of land or water, whether it is an arid desert or covered with vegetation, (*d*) proximity to the sea, to ocean currents, to mountain ranges, etc., (*e*) geological formation, (*f*) the average distribution of pressure as indicated by the configuration of the

* The results of a long series of observations taken at the Royal Observatory, Greenwich, fix the mean annual temperature at 49°·2 F. The more central London stations give a value a degree or two higher. When we reflect upon the enormous extent to which the processes of combustion and respiration take place within the metropolitan area, we need not be surprised at the apparent discrepancy. [The mean of the 9 a.m., 9 p.m., max., and min. temperatures for 45 years at Camden Square is 49°·8.—*Ed. S.M.M.*]

isobars. These factors, of course, interact with one another in the most complex manner in their resultant effect, and it is frequently very difficult to judge to what extent a particular type of weather may be due to the operation of any one of them.

With regard to the relative significance of the climatic factors we may say that in the tropics latitude and altitude play the most important part, but that in the temperate zones the influence of isobars is nearly as great, and sometimes altogether masks the effects of latitude. In the case of the British Isles, the average configuration of the isobars has a most pronounced effect. Thus, were the normal distribution of pressure over Britain anti-cyclonic instead of cyclonic, the influence of a northern latitude would be strongly felt, and the winters would be incomparably severer than they are.*

The mildness of the climate of the British Isles compared with that of many other countries between the same parallels of latitude is frequently attributed to the fact that their western shores are bathed by a body of warm water known as the Gulf Stream. We admit this reservedly. The power of the Gulf Stream to raise the temperature of the air in England is entirely dependent upon the prevailing distribution of atmospheric pressure. Pressure is normally low, especially in winter, in the neighbourhood of Iceland; a gradient for westerly or south-westerly winds across Great Britain is thus set up, and in this way the modifying influence of the Gulf Stream becomes apparent. That the direct influence of the Gulf Stream is imperceptible during the persistence of anti-cyclones is proved by the fact that when anticyclonic conditions of similar intensity dominate the weather over the British Isles, frosts are developed in the most central parts of Ireland almost equal in severity to those experienced in the most central parts of England and Scotland.† Moreover, the warming influence of the Atlantic Ocean is probably inappreciable on those occasions when a cyclonic disturbance traverses these islands in an easterly direction. Depressions move rapidly, continually affecting fresh masses of air, and only their southern outskirts would be fed by air from the Atlantic.

We have here, however, to take special cognizance of the fact that the mean annual temperature of Britain is raised at least 10° F. by the prevailing south-westerly winds, which, blowing as they frequently do from a great distance, doubtless receive an additional store of thermal energy from the warm waters of the Gulf Stream. We have now to observe that, though the configuration of the isobars

* The mean January temperature at Greenwich would be about 20° F., instead of 37° F. as it now is.

† In February, 1895, the minima in the screen were 6° at Parsonstown, 7° at Greenwich and —5° at Loughboro' in Leicestershire. In February, 1902, the respective minima were 13°, 14°, and 8°. In January, 1881, they were 6°, 8°, and 2°. Presuming that anti-cyclonic conditions of equal intensity prevailed all over the British Isles, we see that the recorded temperatures show no relation to proximity to any body of warm water off the western coast, but merely to distance from the sea.

deserves to be ranked as one of the most important factors of the climate of western Europe generally, in some parts of the world the formation of isobaric systems appears, on the contrary, to be a function of climate. Thus the persistent winter anti-cyclones of Canada and Siberia may be safely attributed to the intense cold which in those countries reigns supreme for a longer or shorter period of the year. The increase of pressure thus occasioned by the great cold will in turn promote a further reduction of temperature by permitting terrestrial radiation to take place more freely. We see then in what an intricate manner temperature and pressure may react upon one another. Even in the British Isles, where cyclones and anti-cyclones are merely accidents, as it were, in the general circulation of the atmosphere we may frequently notice this interaction of pressure and temperature. If anti-cyclonic conditions should happen to set in at a time when the country is covered with snow they will persist much longer than, *cæteris paribus*, they otherwise would do, in accordance with the principle that masses of snow produce a further diminution of temperature, and consequent increase of pressure. Doubtless the great frost of 1895 was protracted in this way.

With regard to the mutual relationship between low pressures and temperature, we are perfectly justified in asserting that the convection theory of cyclones, which ascribes their origin to the ascent of masses of heated air, will not account for those of north-western Europe. There are, on the contrary, good reasons for believing that the rapid variations of temperature associated with the passage of winter cyclones are the product, not the cause of cyclone action. We are not at present concerned with the complex problems relating to the distribution and variations of temperature in cyclones; suffice it to say that the convection theory, in so far as it appertains to British cyclones, is totally disproved by the well-ascertained facts that the ascending current in a cyclone is frequently colder than the descending current in the adjacent anti-cyclone, and that atmospheric disturbances are most frequent and violent during the cold months of the year. We must, nevertheless, not forget that if there should happen to be an unstable temperature gradient, that is to say, if the air ascending in the centre of the cyclone should possess a higher temperature than the surrounding air, the system will develop increased energy.* It will be obvious, then, that a constant succession of cyclones must constitute an important factor of climate in a country where such disturbances are not initiated by local variations of temperature.

With regard to the origin of cyclones, we can only say that they are the product of the general circulation of the atmosphere, just as the countless eddies which indent the surface of a river originate in

* Thunderstorms are, no doubt, due to the sudden uprush of warm, moist air, resulting in rapid condensation of vapour and increase of electrical *potential*.

the forward motion of the water itself. Until, however, something more is known of the complex laws which regulate the phenomena of fluids in motion, any speculation as to the conditions requisite for the production of an atmospheric cyclone can amount to no more than a surmise.

Although the sun's rays are required to set the atmosphere in motion by exciting differences of temperature, the actual distribution of pressure over the surface of the globe is rendered extremely complex by the Earth's axial rotation, together with the unknown laws which control the movements of a circulating fluid, so that while all cyclones and anti-cyclones are ultimately traceable to the great thermal slope from the equator to the poles, they in turn react to a greater or less extent upon climate, constituting an important factor in the relative distribution of temperature, wind and rainfall.

THE CLIMATE OF THE BRITISH EMPIRE DURING 1902.

THIS summary should properly have appeared in the previous volume, but although belated, we feel that it should not be excluded. Considerable additions to the list of stations comprised in the climatological tables for the British Empire, have been made during the year 1902, but it is hardly necessary to remind our readers that it is still very far from being fully representative of all the varying climates of the Empire.

Of the new stations Madras is perhaps the most remarkable, since it provides the highest mean annual temperature that has ever been recorded in these tables. Coolgardie also immediately makes an appearance in the summary of extremes, with the very high mean daily range of 25°·5, thus taking the place of Winnipeg, which has provided this item uninterruptedly for 16 years, though it must be noted that Coolgardie owes its great range to high maxima, whereas Winnipeg owed it to low minima. The mean temperature at Winnipeg, for 1902, is the highest since 1879, and although the minimum reached —36°·1, it has seldom been so high in former years. The returns from the arctic station at Dawson were again unfortunately incomplete, but it is worthy of note that the minima of the four months, January, February, November and December, were respectively —50°·0, —49°·0, —48°·0, and —51°·0, while in December the mean maximum was —16°·7, and the mean minimum —28°·2. The rainfall was greatest, as usual, at Colombo, where the fall was heavier, with one slight exception, than in any year since 1878.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1902.

Stations. *Those in Italics are South of the Equator.*	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Mean.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Average. Cloud.
	°		°		°	°	°	°		°	°	in.		0—10
London	85·1	July 15	15·8	February 16	57·4	42·9	50·1	43·5	79	132·1	14·3	20·84	162	6·6
Malta	99·7	July 25	40·4	February 17	72·5	59·3	65·9	56·3	76	148·3	34·1	24·84	66	3·3
Lagos, W. Africa	95·1	April 13	66·1	December 29	86·4	75·7	81·1	74·7	79	148·0	...	45·94	70	...
Cape Town	98·9	March 20	38·3	August 18	70·6	54·4	62·5	53·0	72	...	...	33·74	122	4·6
Durban	105·6	Sept'mber 23	47·4	June 14	79·2	61·0	70·1	...	...	156·1	...	41·18	160	4·6
Mauritius	89·9	Nov'mber 20	51·9	August 12	81·8	68·0	74·9	65·6	75	159·2	44·8	47·11	184	5·7
Calcutta*	...	.....	...	.....	...	...	...	...	...	159·0	41·1	62·28	83	4·5
Bombay	94·9	June 3	64·1	February 7	87·4	76·6	82·0	72·9	75	143·5	54·9	71·97	100	3·8
Madras	108·0	May 8	62·2	February 6	91·0	75·4	83·2	72·0	76	153·0	58·2	54·44	104	4·6
Kodaikanal	75·2	March 23 / May 7	39·4	January 26	64·7	51·3	58·0	...	75	145·3	27·2	72·53	184	5·3
Colombo, Ceylon	93·4	March 5	65·2	January 24	87·3	75·5	81·4	73·3	80	158·0	61·3	117·01	198	5·8
Hongkong	92·2	July 27	40·5	February 4	78·2	69·6	73·9	65·3	76	150·6	...	97·52	136	6·3
Melbourne	103·0	January 31	29·6	August 14	67·0	49·1	58·0	47·3	71	161·7	21·3	23·08	102	6·0
Adelaide	111·4	February 11	36·9	June 26 / July 9, 10	73·7	53·1	63·4	47·3	59	167·9	30·9	16·02	124	4·8
Coolgardie	108·6	December 20	31·9	July 30	77·9	52·4	65·1	...	...	...	24·0	14·69	51	3·5
Sydney	100·0	December 24	40·3	August 1	69·7	56·5	63·1	...	73	151·2	31·8	43·07	176	4·8
Wellington	81·0	January 13	32·0	July 17	60·6	47·8	54·2	44·5	71	136·0	24·0	38·75	201	5·8
Auckland	79·5	March 1	38·5	July 17	63·1	51·7	57·4	46·6	67	144·0	33·0	38·28	184	5·1
Jamaica, Negril Pnt.	...	.....	...	.....	85·9	72·2	79·1	71·9	78	...	...	50·78	123	...
Trinidad	97·0	December 1	61·0	January 5	87·6	69·6	78·6	73·4	82	177·0	58·0	55·34	139	...
Grenada	90·8	May 18	68·4	June 30	83·4	74·1	78·8	70·5	74	160·0	...	70·86	226	2·9
Toronto	91·0	July 8	—3·3	December 9	54·2	37·4	45·8	39·6	78	107·8	—10·2	31·04	155	6·3
Fredericton, N.B.	84·7	June 2	—22·0	February 12	52·0	20·6	41·7	30·8	60	...	...	49·66	147	5·9
Winnipeg	91·2	August 5	—36·1	January 27	48·6	26·6	37·6	...	...	...	...	20·22	98	5·7
Victoria, B.C.	86·2	July 19	12·3	January 25	55·9	44·5	50·2	...	...	...	...	26·45	151	6·5

* Thermometer shed under repair February 11th—20th.

SUMMARY.

Highest Temp. in Shade	111°·4 at Adelaide on February 11th.
Lowest „ „	—36°·1 at Winnipeg on January 27th.
Greatest Range in year	127°·3 at Winnipeg.
Least „ „	22°·4 at Grenada.
Greatest Mean Daily Range...	25°·5 at Coolgardie.
Least „ „ ...	8°·6 at Hongkong.
Highest Mean Temp.	83°·2 at Madras.
Lowest „ „	37°·6 at Winnipeg.
Driest Station	Adelaide, mean humidity, 59.
Dampest „	Trinidad „ „ 82.
Highest Temp. in Sun.....	177°·0 at Trinidad.
*Lowest Temp. on Grass**	—10°·2 at Toronto.
Greatest Rainfall.....	117·01 in. at Colombo, Ceylon.
Least „	14·69 in. at Coolgardie.
Most Cloud	6·6 at London.
Least „	2·9 at Grenada.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

BELVILLE'S JOURNALS.

I HAVE been considering the point raised by you in your editorial note last month, with reference to the rainfall of 1824, and I am still of the opinion that the record was made at the Royal Observatory. I am aware that Mr. Eaton, in his account of Belville's Journals, given in his paper on "The Mean Temperature of the Air at Greenwich" ("Quarterly Journal, Royal Meteorological Society," vol. xiv., January, 1888), inclines to the belief that the entries in the Royal Observatory M.S. Journal, from 1822 to 1826, are transcripts of Belville's observations at Park Row and Park Terrace. But it would appear that Belville on changing his residence in 1822 did not remove the rain gauge from the Observatory, and it continued in use there until 1878, and is now in the Observatory Museum. The rain table cited by you was drawn up many years ago by Mr. Glaisher, and all the values in the early years (prior to 1841) were raised in the proportion of ten to eleven, under a mistaken notion with regard to the position of the gauge.

W. C. NASH.

Blackheath, 9th February, 1904.

* The minimum on grass is not recorded at the other Canadian stations. In every case the extreme conditions refer only to the stations quoted in the Climatological Table. It is quite possible that other places in the empire were hotter, colder, wetter or drier, than any here cited.

THE STUDY OF SUNSPOT CYCLES.

The method suggested by Mr. J. Edmund Clark, in Vol. **38**, p. 136, for arranging the years in order to obtain meteorological means conforming to the sunspot cycle, seems to me a useful one. However, the years of maxima given by him do not conform in many cases with the years recently given by Wolfer in the revision of the relative sunspot numbers. (*See* the *Astronomische Mittheilungen*, vol. **93**, and the *United States Monthly Weather Review* for April, 1902).

Also, there seems to me more joining of two years in one in the scheme of Mr. Clark than is necessary. Hence I have arranged the years in the following manner. In this scheme the years of maxima and minima all conform with the dates given by Wolfer, except the maximum of 1804. In this case there was a prolonged maximum, extending from 1802—1805, and it seems to me the maximum more properly belongs in 1804 rather than in 1805, as given by Wolfer.

A Plan for Reduction of Years to Mean Sunspot Curve.

	Min.					Max.						Wolfer's
Cycle.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	Maxima.
1745·0—1750·3...	45	6	7	8	9	50	1	2	2-3	3	4	1750·3
1755·2—1766·5...	55	6	7-8	9	0	61	2	3	3-4	4	5	1761·5
1766·5—1775·5 ..	66	7	7	8	8	69	0	1	2	3	4	1769·7
1775·5—1784·7...	75	6	6	7	7	78	9	0	1	2	3	1778·4
1784·7—1798·3...	84	5	6	6	7	88	9	0-1	2-4	5-6	7	1788·1
1798·3—1810·6...	98	9	0	1-2	3	04	5	6	7	8	9	1805·2
1810·6—1823·3...	10	1	2-3	4	5	16	7	8	9-0	1	2	1816·4
1823·3—1833·9...	23	4	5-6	7	8	29	0	1	1	2	2	1829·9
1833·9—1843·5...	33	4	5	5	6	37	8	9	0	1	2	1837·2
1843·5—1856·0...	43	4	5	6	7	48	9	0	1-2	3	4	1848·1
1856·0—1867·2...	55	6	7	8	9	60	1	2	3-4	5	6	1860·1
1867·2—1878·9..	67	8	8	9	9	70	1	2-3	4	5-6	7	1870·6
1878·9—1889·6...	78	9	0	1	2	83	4	5	6	7	8	1883·9
1889·6—1901·5 ..	89	0	1	2	3	94	5	6	7-8	9	0	1894·1

HENRY HELM CLAYTON.

Hyde Park, Mass., U.S.A., Jan. 24, 1904.

SQUALLS OF JANUARY 13th–14th.

I should like to know whether what I observed here on Wednesday, January 13th, was observed by other readers of this Magazine. Between 9.30 and 10 p.m. there were three flashes of lightning seen over the Channel. At 11.30 p.m. a squall came over here, wind being W. to S.W., accompanied with hail, thunder and lightning, lasting about ten minutes.

Then at 2.30 a.m. on Thursday morning the same occurrence was witnessed, the lightning lasting longer. At 5.30 a.m. there was another squall of a like nature, the lightning lasting longer than the other two.

What I think is curious is that they all commenced at the half *hours. All the squalls* had hail, which on making its first appear-

ance was accompanied by a bright flash of lightning and a loud clap of thunder. My recording barometer went down to 29·06 inches at 5.30 and was wavy from 2 to 6 o'clock.

HENRY NEWBY.

32, Magdalen Road, St. Leonards-on-Sea, Jan. 14th, 1904.

[Many correspondents refer to the thunderstorms of January 13th—14th, which were general over the south of England. At least one of the squalls referred to in the above letter was of exceptional severity, as is shown by the following extract from *The Times* of January 15th :—

"A severe gale broke over Brighton and Hove in the early hours of yesterday morning. At 2 p.m.* a squall swept over the towns, doing considerable damage. A number of chimney stacks were blown down, and some of the streets were strewn with slates. A lady had a wonderful escape at the Princes Hotel, Hove. A stack of five chimneys fell from a height of about 50 ft. upon the roof of the hotel on the west side. The roof gave way, and the lady, who occupied a bedroom beneath, was almost buried in the wreckage. The building was very strongly constructed, and one of the beams supporting the roof, falling crosswise into the room, helped to prop up the sheets of lead flung down from the roof, and thus a kind of protective canopy was formed over the bed, and to this the occupant owed her life, though she sustained a severe wound. A bell was close to her, but she was unable to reach it, and had to lie exposed to the fury of the storm until 7 o'clock, when she was rescued."

It is an interesting fact that the Redier barograph at Camden Square recorded a sudden fall of ·025 inch and an almost immediate recovery at 2.30 a.m., the period of this abrupt reduction of pressure being so short that the downward and upward movement of the pencil showed only a single line, and did not interfere with the steady fall of the barometer which was in progress at the time.]—ED. *S.M.M.*

METEOROLOGICAL NEWS AND NOTES.

THE HEAVY RAINFALL OF 1903 will not soon be forgotten. It has made for itself a place in literature, and a correspondent recalls to our attention that the pluviometric conditions are thus enshrined in the felicitous dog Latin of the Westminster School Play :—

"*Totum annum pluvit felibus et canibus.*"

MR. WILLIAM S. BRUCE, of the Scottish National Antarctic Expedition, has offered to hand over Omond House and Copeland Observatory, in the South Orkneys, to the Argentine Meteorological Office, and to give four scientific men chosen by them a free passage and eighteen months' provisions, if they will undertake to continue during the next year the meteorological and magnetical work which the Scottish Expedition has initiated and carried on during the past year. We have reason to believe that this offer will be accepted and that Mr. R. C. Mossman, Meteorologist to the Scottish Expedition,

* This is obviously a misprint for 2 a.m.—ED. *S.M.M.*

will remain in charge of the station. The Scottish Expedition hoped to continue meteorological and other research to the south-east of the South Orkneys during the present season. A labour strike in Buenos Aires has, however, seriously impeded the refitting of the "Scotia," and the summer has already almost passed.

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday, January 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

The Council in their Report congratulated the Society on the steady increase in the number of Fellows. The Symons Gold Medal had been awarded to Hofrath Dr. Julius Hann, of Vienna, in consideration of his eminent services to the science of Meteorology. The Society's Howard Silver Medal, annually awarded to the cadets of "H.M.S. Worcester," had been gained by Cadet H. Wormell for his essay on "The use of Clouds in forecasting the Weather." A new section had been added to the *Quarterly Journal*, entitled "Meteorological Literature," which gives the titles of such papers as appear to be of general interest, bearing on Meteorology, in the periodicals which are received in the Society's Library. The Council also referred to the Kite Observations carried out by Mr. Dines during the past summer on the west coast of Scotland, which had been made under very unfavourable conditions as regards both the weather and the vessel which had to be employed.

The Report having been adopted and the usual votes of thanks passed, the President read from the Council minutes a statement of Dr. Julius Hann's services to Meteorology, and then with a few appropriate words handed the Symons Gold Medal to Count L. Széchenyi, First Secretary to the Austro Hungarian Embassy, who was present to receive it on behalf of Dr. Hann.

The President then delivered an address on "The Present Condition of Ocean Meteorology." He said that he had chosen that subject because he believed that the solution of many weather problems must be sought in close study of atmospheric conditions over oceanic areas. He referred to the early workers in meteorological science, Captain Maury in America and Admiral FitzRoy in this country, and also to the addresses on the subject delivered to the Society some years ago by Dr. R. H. Scott. The President then sketched the present state of our knowledge, illustrating his remarks by numerous slides of isobaric, isothermal and other maps of the various oceans drawn on Flamsteed's projection. He reviewed the meteorological work of different nations, pointing out the energetic action of the United States in particular, and also of Germany and Great Britain. He was of opinion that we had reached the limits to which it was possible for us to go in weather forecasting with the

meteorological knowledge at present within our reach. What was now required was a liberal infusion of scientific imagination into our methods. It was to be hoped that a meteorological Darwin might appear, to set us once for all in the path for which we were groping. In conclusion, he regretted the want of liberality shown by the Government in affording financial aid for the development of this important science; and he urged the necessity of interesting the youth of the country in the matter, by making it a special subject of the curriculum in schools and colleges.

A vote of thanks having been passed to the President for his address, the scrutineers of the ballot announced that the following gentlemen had been elected the Officers and Council for the ensuing year :—

President—Captain D. Wilson-Barker. *Vice-Presidents*—Mr. W. H. Dines, Mr. J. Hopkinson, Mr. H. Mellish, and Dr. W. N. Shaw, F.R.S. *Treasurer*—Dr. C. Theodore Williams. *Secretaries*—Mr. F. Campbell Bayard and Dr. H. R. Mill. *Foreign Secretary*—Dr. R. H. Scott, F.R.S. *Council*—Mr. R. Bentley, Mr. J. Y. Buchanan, F.R.S., Capt. W. F. Caborne, C.B., Mr. R. H. Curtis, Dr. H. N. Dickson, Mr. F. Druce, Sir J. Eliot, F.R.S., Mr. W. Ellis, F.R.S., Capt. M. W. C. Hepworth, C.B., Mr. R. Inwards, Mr. Baldwin Latham, and Mr. E. Mawley.

The Annual General Meeting was preceded by a brief Ordinary Meeting, at which the following gentlemen were elected Fellows :—Mr C. Beadle, Mr. H. Garnett, Mr. C. W. Nicholl, and Mr. W. I. Walker.

BEN NEVIS OBSERVATIONS AND WEATHER FORECASTS.

By the courtesy of Dr. A. Buchan, F.R.S., we have been favoured with a copy of the Report of the Committee on Meteorological Observations on Ben Nevis, presented to the British Association at the Southport meeting in 1903.

It contains the following interesting statement of the views of the Director of the Observatory as to the possibility of utilizing the observations for the purpose of weather forecasts :—

Some of the results have a special bearing on forecasting. One or two illustrative cases may be here added.

1. The occurrence of small differences of temperature between Ben Nevis and Fort William, associated with very low humidities at Ben Nevis and great dampness at Fort William, and the relations of this state of things to the stability and continuance of an anticyclone, and also to thunderstorms and those heavy local rains commonly denoted as thunder-showers, have been reported on.

2. The occurrence of long-continued periods of saturation of the air at the top of Ben Nevis, as indicative of a condition of the atmosphere favourable to the development and continuance of stormy weather.

3. A marked difference in the *direction* of the wind on the summit from that at surrounding low-level stations. Such a difference most commonly occurs when Ben Nevis lies between a cyclone and an anticyclone, and may be

indicative of the direction of movement either of the cyclone or the anti-cyclone.

4. The predictive aspects of *very strong* winds on the summit of Ben Nevis accompanied, notwithstanding their great force, with very low temperatures there and great differences of temperature between the summit and Fort William, and the intimate connection of the whole with cyclonic weather, have been pointed out. Recent kite observations have made us tolerably familiar with this remarkable phase of the cyclone, and to Ben Nevis we may look for important contributions of illustrative data.

5. The difference between the Ben Nevis and Fort William barometers when both are reduced to sea-level. This difference, when it amounts to several hundreths of an inch, clearly points to an abnormal condition of the air between the summit and Fort William in respect to the vertical gradient of temperature or humidity, or both.

The investigation of some of the points raised in this discussion has been a chief subject of inquiry during the past eighteen months. The inquiry is a discussion of the hourly observations of pressure, temperature, humidity, sunshine, winds and rainfall at the two Observatories in their inter-relations, more especially as regards the bearings of the results on weather changes.

The principal point to be kept in view is the relation of the differences of temperature at the two Observatories to the differences of their sea-level pressure at the time. An illustration will explain this. During the last three days of September, 1895, the sky over Scotland was clear, sunshine strong, humidity high, night temperatures unusually high, and dews heavy, with calms or light winds. On these days while at the top temperature was very high and the air clear and very dry, at Fort William, under a sky equally clear and temperature high, the air showed a large humidity, and this state of moisture extended to a height of about 2,000 feet, or nearly halfway to the summit. Thus, then, while the barometer at the top was under an atmosphere wholly anticyclonic, with its accompanying dry dense air, the barometer at Fort William was not so circumstanced. On the other hand, it was under the pressure of such dry dense air, above the height of 2,000 feet only, whereas from this height down to sea-level it was under the pressure of air whose humidity was large and pressure therefore much reduced. The result was that the sea-level pressure at Fort William was 0·050 inch lower than it would have been if the dry dense air of the anticyclone had been continued down to Fort William. This is confirmatory of what is to be expected, that the greater density of dry air as shown in our laboratories prevails equally in the free atmosqhere.

The first part of the discussion is virtually finished, the chief result of which is this :—1. When the differences of mean temperature of the day is only 12°·0 or less, then the sea-level pressure calculated for the top of the mountain is markedly greater than at Fort William. 2. When the difference of temperature is 18°·0 or greater, then the sea-level pressure for the summit is markedly lower than at Fort William. In the former case the meteorological conditions are anticyclonic, the weather being then clear, dry, and practically rainless; and in the latter case the conditions are cyclonic, the accompanying weather being dull, humid, and rainy. In the course of this discussion it has been marked that the reduced hourly values from day to day often indicate that the transition from the anticyclonic to the cyclonic type of weather, and *vice*

versa, is slow, sometimes extending over several days, thus prolonging the time for the prediction of the more important weather changes.

It may be remarked that the result here empirically arrived at is in accordance with the principle laid down by Dalton, that 'air charged with vapour or vaporised air is specifically lighter than when without the vapour; or in other words, the more vapour any given quantity of atmospheric air has in it, the less is its specific gravity.'

The precursor and accompaniment of the heaviest and most widespread rains is when the sea-level pressure for the summit is very greatly lower than the sea-level pressure at Fort William. This indicates the saturation of the atmosphere to a great height, while at Fort William, and, say, 2,000 feet higher, the point of saturation due to the advancing cyclone has not yet taken place.

On the other hand, when this point of saturation has been reached, then the sea-level pressure for the summit shows less difference from the sea-level pressure at Fort William. The changes of pressure which occur at the two Observatories as a cyclone advances and passes on are particularly interesting and instructive.

It is remarkable that comparatively few observations, when the difference of the temperature has exceeded 22°·0, could be utilised in this inquiry, because in such cases high winds prevailed, resulting in 'pumping' of the barometer. These differences of temperature, rising even to 27°·0, are however extremely valuable for weather prediction, inasmuch as they often precede and accompany very severe storms of wind and rain. They arise from an extraordinary lowering of the temperature at the summit while at Fort William no such lowering of temperature occurs. This is a peculiarity which kites and balloon ascents have recently familiarised us with, and it forms a prime factor in all inquiries into the theory of the cyclone, about which opinion at present is so much divided.

RAINFALL ON THE RIVER BANN, CO. DOWN, AT BANBRIDGE AND LOUGH ISLAND REAVY RESERVOIR FOR 40 YEARS FROM 1862 TO 1901.

By John Smyth, M.A., M.Inst.C.E.I.

(*Concluded.*)

The Tables of monthly rainfall, published in the number of this Magazine for December last, will be brought up to the end of 1903 by the following additions.—

Station.	October. ins.	November. ins.	December ins.	Total.
Milltown, Banbridge	4·6	2·1	2·3	38·4
Bann Reservoir	8·5	2·2	6·7	60·1

The greatest ten-year average at Bann Reservoir, Lough Island Reavy, is 49·05 from 1894 to 1903, which exceeds the greatest ten-year average in the 40 years, 1862-1901. Although the ten months' rainfall ending November 30th, 1903, is the greatest on record, yet the year's rainfall at Lough Island Reavy was less than that of 1872.

Some interest attaches to the monthly aggregates of rainfall in each year, and these are accordingly added.

Summary of Rainfall at Milltown, Banbridge, co. Down.

Year.	Jan.	First 2 mos.	First 3 mos.	First 4 mos.	First 5 mos.	First 6 mos.	First 7 mos.	First 8 mos.	First 9 mos.	First 10mos.	First 11mos.	12 mos
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1862.....	3·6	4·6	7·3	10·1	13·9	16·7	20·2	22·0	23·9	27·5	30·1	33·2
1863.....	3·1	3·9	5·6	6·9	9·4	12 1	12·9	16·7	19 7	25·3	27·6	29·4
1864.....	1·4	2·6	4·6	6·7	8·5	11·1	12·4	14·8	17·3	19·7	23·2	25·2
1865.. ...	2·7	5·4	7·6	8·2	12·4	12·9	14·4	17·1	17·4	23·4	26·9	29·1
1866.....	3·5	5·8	8·3	9·8	10·7	12·8	14·9	17·6	21·1	23·1	25·4	28·1
1867.....	3·7	5·4	7·4	11·2	14·1	15·1	21·5	23·5	25·2	29·5	30·3	31·9
1868.. ...	2·5	4·7	7·6	9·7	12·0	12·7	13·6	17·6	19·2	21·0	23·5	28·0
1869.....	3·4	7·5	9·4	11·4	13·5	14·4	15·9	17·5	21·4	22·9	26·0	29·2
1870.....	3·0	5·4	6·5	7·6	9·2	10·2	12·0	13·6	16·1	23·3	25·1	27·6
1871.....	3·1	5·9	7·3	10·2	11·0	12·8	16·8	20·2	23·8	26·1	27·7	29·6
Average of 10 years	3·0	5·2	7·2	9·2	11·5	13·1	15·5	18·1	20·5	24·2	26·6	29·1
1872.....	4·1	7·6	10·0	14·1	16·8	20·4	23·7	27·9	32·3	36·8	41·0	46·6
1873.....	4·0	5·1	7·4	7·9	9·8	11·3	15·4	19·8	22·5	25·2	27·0	27·6
1874.....	1·7	3·5	4·8	6·5	7·2	8 3	11·2	15·6	18·5	22·1	25·3	28·3
1875.....	3·9	5·7	6·7	7·1	8·6	11·9	15·8	18·2	22·9	26·4	29·7	31·4
1876.....	1·1	4·5	7·4	9·5	10·0	12·0	14·0	16·9	20·3	24·8	28·3	36·0
1877.....	5·9	8·3	11·9	15·0	18·5	20·9	25·7	29·1	31·2	33·9	37·2	40·0
1878.....	3·1	5·1	6·6	8·0	11·8	14·8	15·2	17·7	21·0	23·9	25·4	26·9
1879.....	2·3	3·8	5·8	7·5	11·3	15·3	21·4	25·2	29·6	30·7	32·0	33·3
1880.....	1·0	3·5	5·3	9·0	9·6	12·5	17·3	18·2	21·4	22·6	25·0	27·6
1881.....	0·7	3·5	6·4	8·1	10·7	14·9	17·8	22·5	24·7	28·2	32·0	35·0
Average of 20 years	2·9	5·1	7·2	9·2	11·4	13·6	16·6	19·6	22·5	25·8	28·4	31·1
1882.....	1·9	4·0	6·4	9·1	12·0	15·1	20·1	23·7	28·0	30·4	35·0	37·6
1883.....	3·5	6·6	8·1	9·5	11·5	13·6	18·3	22·1	25·8	28·4	31·7	33·6
1884.....	3·8	7·2	9·9	11·8	13·9	14·7	17·6	19·4	22·4	24·8	27·3	30·4
1885.....	2·2	5·9	7·5	9·5	11·3	12·0	13·9	15·3	19·9	23·0	24·6	26·6
1886.....	3·8	5·9	8·5	9·9	15·0	16·4	19·9	22·3	24·7	28·8	31·7	36·1
1887.....	2·5	3·5	5·0	7·0	8·5	9·2	11·9	14·0	17·0	18·9	21·4	23·1
1888.....	1·8	2·3	5·7	7·4	10·1	14·5	19·1	21·8	22·8	23·9	27·8	30·2
1889.....	1·8	3·9	6·2	9·5	12·9	13·2	16·9	24·5	26·2	29·4	31·0	33·9
1890.....	3·3	4·6	7·3	8·4	9·9	12·8	14·9	17·5	20·7	22·2	28·2	29·9
1891.....	1·1	1·3	2·5	5 0	8·1	11·1	14·0	19·3	21·2	24·8	27·2	31·1
Average of 30 years	2·8	4·8	7·2	9·1	11·4	13·5	16·6	19·7	22·6	25·7	28·5	31·2
1892.....	2·1	3·9	4·5	5·3	8·7	11·8	14·4	19·9	22·8	25·8	29·3	31·1
1893.....	2·7	5·2	5·9	7·0	7·9	9·5	12·2	16·5	18·2	20·0	21·4	24·0
1894.....	2·9	4·8	5·9	8·3	9·9	13·4	16·7	19·0	19·3	24·3	26·0	28·8
1895.....	1·9	2·6	5·7	7·7	7·9	10·4	15·1	20·1	20·6	24·1	27·5	30·3
1896.....	1·7	3·0	6·0	7·3	7·6	10·1	17·5	19·5	24·0	26·1	26·8	30·6
1897.....	1·8	3·6	7·8	10·2	11·9	16·4	18·1	22·1	24·2	26·4	29·6	32·8
1898.....	1·2	3·8	4·7	8·2	11·9	14·9	15·5	19·1	23·9	27·1	29·1	31·0
1899.....	2·8	5·3	6·7	9·6	13·2	15·6	19·1	20·3	23·7	25·5	28·3	32·3
1900.. ...	2·0	4·3	5·2	6·9	9·6	12·8	15·8	20·6	22·4	26·0	30·9	34·1
1901.....	2·8	4·2	6·3	8·4	9·9	12·6	13·7	18·0	21·5	24·1	28·1	31·3
Average of 40 years	2·6	4·7	6·9	8·8	11·0	13·3	16·4	19·7	22·5	25·5	28·3	31·1
1902.....	1·9	4·4	6·0	8·6	12·1	14·3	17·9	20·3	24·0	25·3	28·6	31·0
1903.....	4·3	6·1	10·0	10·9	13·2	14·4	20·4	25·5	29·4	34·0	36·1	38·4

Summary of Rainfall at Bann Reservoir, Lough Island Reavy, near Castlewellan.

Year	Jan.	First 2 mos.	First 3 mos.	First 4 mos.	First 5 mos.	First 6 mos.	First 7 mos.	First 8 mos.	First 9 mos.	First 10mos.	First 11 mos	12mos.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1862.....	6·0	8·6	14·2	17·5	20·5	25·5	29·9	31·9	33·9	39·6	44·6	52·9
1863.....	4·3	5·3	10·2	11·2	13·6	17·0	17·8	23·0	25·0	36·8	40·3	42·8
1864.....	5·2	6·4	13·1	15·1	16·8	19·5	21·1	22·9	26·0	30·5	40·8	44·7
1865.....	5·0	8·7	10·6	11·1	15·7	16·5	19·4	23·9	24·2	36·2	45·5	52·3
1866.....	7·7	11·7	20·1	24·0	24·9	29·9	31·3	35·3	41·7	46·5	50·4	54·6
1867.....	4·4	6·4	13·5	18·5	26·7	27·2	33·7	35·4	38·4	45·0	45·5	47·2
1868.....	3·8	5·5	8·6	9·9	12·3	12·5	12·9	19·9	22·4	24·3	32·2	43·3
1869.....	7·1	9·7	11·6	12·8	14·9	15·0	16·2	17·8	22·5	23·3	25·2	28·9
1870.....	5·9	14·3	15·2	16·0	19·4	19·9	20·8	22·4	25·2	39·9	42·4	48·1
1871.....	4·5	11·0	13·1	18·4	18·9	20·7	24·0	26·4	32·1	37·1	40·4	43·0
Average of 10 years	5·4	8·8	13·0	15·4	18·4	20·4	22·7	25·9	29·1	35·9	40·7	45·8
1872.....	7·2	16·2	19·2	22 8	24·3	27·6	30·7	34·0	38·0	43·4	50·2	61·2
1873.....	6·2	7·0	11·4	11·7	12·9	14·8	19·0	22·9	24·8	26·4	30·4	31·2
1874.....	2·1	6·1	6·9	9·9	10·2	10·9	12·9	16·8	21·6	27·9	31·5	35·5
1875.....	7·1	8·3	9·7	10·0	12·2	16·0	19·2	22·0	27·6	33·9	39·0	41·4
1876.....	2·3	6·0	8·1	10·1	10·3	12·3	13·1	16·5	22·3	31·2	39·9	52·9
1877.....	11·9	13·6	17·2	22·8	26·6	29·9	32·6	36·8	38·7	42·5	48·5	54·1
1878.....	2·2	6·4	6·8	8·6	15·5	18·4	18·8	21·4	26·2	30·3	31·2	31·9
1879.....	2·7	5·7	7·9	11·4	13·0	19·1	25·0	29 7	36·9	37·8	38·7	39·8
1880.....	1·1	5·5	7·2	13·0	13·1	16·1	22·3	22·6	27·1	29·4	32·9	33·8
1881.....	0·4	5·0	9·7	10·4	11·2	15·2	16·0	19·6	20·8	23·6	29·6	34·4
Average of 20 years	4·8	8·4	11·7	14·3	16·6	19·2	21·8	25·1	28·8	34·3	39·0	43·7
1882.....	1·6	7·5	10·0	16·1	18·5	21·2	25·9	30·4	34·8	41·7	48·3	53·1
1883.....	5·8	15·0	16·9	18·7	20·0	20·7	23·2	26·7	35·7	39·7	42·4	43·3
1884.....	5·7	13·6	21·0	23·1	25·6	25·9	28·9	30·2	32·1	33·8	38·1	40·6
1885.....	3·8	9·8	12·2	18·8	20·8	21·2	22·0	24·1	31·5	35·5	40·5	40·9
1886.....	2·2	4·4	7·8	9·6	13·3	16·6	19·9	21·9	24·1	33·2	37·0	42·3
1887.....	3·9	4·9	5·6	6·9	7·9	8·7	11·8	14·8	17·9	20·4	24·4	26·5
1888.....	1·6	1·6	7·2	10·0	14·1	19·3	25·9	27·4	27·9	29·1	37·5	43·3
1889.....	6·3	6·7	9 9	16·0	22·3	22·3	25·8	30·4	32·9	40·5	41·4	44·7
1890.....	4·8	7·5	13·2	15·2	17·7	20·5	22·5	26·7	31·1	32·4	43·3	46·3
1891.....	1·6	1·9	3·7	10·0	13·5	20·0	22·9	31·3	33·8	44·2	52·9	59·0
Average of 30 years	4·5	8·0	11·4	14·3	16·9	19·3	22·2	25·5	29·2	34·5	39·5	43·8
1892.....	4·1	6·0	6·5	7·4	11·6	15·2	17·0	23·2	27·1	34·0	40·0	41·3
1893.....	5·7	9·3	9·9	11·1	12·1	13·9	16·8	21·4	22·9	24·4	27·0	33·1
1894.....	5·9	8·8	9·4	13·9	17·9	21·7	25·6	27·8	28·1	39·0	44·7	48·6
1895.....	3·6	4·1	9·0	12·7	12·8	14·0	19·2	26·1	26·4	29·9	38·0	42·1
1896.....	1·8	4·6	8·3	9·3	9·7	13·1	19·8	21·7	28·5	30·9	33·1	40·3
1897.....	3·1	5·8	12·7	16·1	17·7	23·8	25·5	32·4	34·8	38·9	42·7	48·6
1898.....	1·9	4·7	5·7	12·4	17·0	21·3	21·8	25·5	29·5	34·6	39·1	43·0
1899.....	5·5	11·2	13·2	17·8	22·4	25·6	29·2	31·0	34·6	36·0	41·5	49·9
1900.....	3·3	8·7	9·7	12·3	17·2	20·6	25·0	30·1	31·3	37·0	44·2	49·1
1901	6 9	10·3	13·6	17·9	20·1	23·8	25·5	28·8	35·8	40·4	45·0	49·6
Average of 40 years	4·4	7·8	11·0	14·0	16·7	19·3	22·3	25·8	29·4	34·5	39·5	44·0
1902.....	3·3	8·9	11·1	16·2	23·2	27·3	32·5	37·0	41·8	44·5	54·3	59·2
1903.....	*7·4*	*12·4*	*20·0*	*21·8*	*24·6*	*25·8*	*31·5*	*37·4*	*42·7*	*51·2*	*53·4*	*60·1*

RAINFALL AND TEMPERATURE, JANUARY, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Greatest in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. Shade	No. of Nights below 32°. Grass
		inches.	inches.	in.								
I.	London (Camden Square) ...	2·33	+ ·62	·35	30	22	55·3	13	25·1	1	13	22
II.	Tenterden ...	3·71	+ 1·72	·48	27, 30	23	51·4	13	23·0	1	10	22
,,	Hartley Wintney ...	3·21	+ 1·26	·63	30	22	54·0	13	20·0	1	13	22
III.	Hitchin ...	2·19	+ ·48	·46	30	20	54·0	13	23·0	22	16	...
,,	Winslow (Addington) ...	2·73	+ 1·02	·51	30	21	52·0	13	20·0	23	20	24
IV.	Bury St. Edmunds (Westley)	1·72	+ 0·3	·28	30	17	54·0	13	25·0	17	...	...
,,	Brundall ...	1·51	— ·16	·26	31	20	55·0	13	23·2	23	11	21
V.	Alderbury ...	4·89	+ 2·38	·72	27	23	47·0	28, 29	24·0	19	15	...
,,	Winterborne Steepleton ...	6·43	...	·72	30	23	50·9	13	23·0	23	11	18
,,	Torquay (Cary Green) ...	5·56	...	·92	29	21	54·1	19	31·5	1	1	13
,,	Polapit Tamar [Launceston]	6·19	+ 2·86	·72	13	25	53·6	13	22·1	23	7	12
VI.	Stroud (Upfield) ...	3·77	+ 1·56	·43	31	23	52·0	18	27·0	22	14	...
,,	Church Stretton (Woolstaston)	3·13	+ ·67	·45	13	25	50·5	12, 18	24 0	1, 2	15	...
,,	Bromsgrove (Stoke Reformatory)	2·27	+ ·58	·33	27	17	49·0	27	21·0	22	20	...
VII.	Boston ...	1·57	+ ·19	·35	31	13	50·0	13	27·0	6	...	...
,,	Bawtry (Hesley Hall) ...	1·68	+ ·27	·38	31	19	54·0	13	24·0	22	16	...
,,	Derby (Midland Railway)...	2·05	+ ·45	·30	31	20	52·0	13, 27	25·0	23	13	...
VIII.	Bolton (The Park) ...	3·67	+ ·62	·79	12	25	50·5	27	26·8	1, 2	9	21
IX.	Wetherby (Ribston Hall) ...	2·46	+ ·80	·41	8	19	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	7·62	+ 1·24	1·06	7	22	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	1·43	— ·24	·30	12	15	53·0	13	27·0	22	10	26
X.	Newcastle (Town Moor) ...	1·76	— ·05	·48	12	17	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	15·90	+ 1·05	2·84	9	18	...	...	...	...	...	...
XI.	Cardiff (Ely) ...	5·37	+ 1·81	·95	7	23	...	...	...	...	...	...
,,	Haverfordwest (High St)..	5·71	+ 1·09	·95	6	22	50·9	13	26·5	1	4	14
,,	Aberystwith (Gogerddan)..	4·79	+ ·54	·81	12	21	53·0	26	22·0	5, 23	12	...
,,	Llandudno ...	3·48	+ ·95	·49	8	22	54·0	27	25·5	1	3	...
XII.	Cargen [Dumfries] ...	4·02	— ·56	·69	9	19	51·0	19	27·0	2	12	...
XIII.	Edinburgh (Royal Observy.)	2·87	...	·45	7, 31	15	50·3	27	28·5	2	7	15
XIV.	Colmonell ...	4·90	+ ·06	·60	30	18	50·0	19, 27	31·0	31	...	...
XV.	Tighnabruaich ...	7·34	...	1·08	10	22	52·0	8	26·0	15	11	13
,,	Mull (Quinish) ...	7·13	+ ·90	·81	6	24	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	2·71	— ·59	·75	11	16	...	...	...	...	.	...
,,	Dundee (Eastern Necropolis)	1·85	— ·68	·40	31	17	51·4	18	29·4	16	8	...
XVII.	Braemar ...	3·65	+ ·87	·56	29	22	49·2	18	25·0	31	16	29
,,	Aberdeen (Cranford) ...	2·32	— ·40	·39	31	24	51·0	18	26 0	11, 23	14	...
,,	Cawdor (Budgate) ...	1·61	— ·61	·48	13	15	...	...	...	...	..	...
XVIII.	Strathconan (Dalbreac) ...	6·56	+ 2·02	1·08	29	...	...	...	...	...	...	...
,,	Glencarron Lodge ...	10·67	+ ·28	1·23	6	25	51·0	27	25·7	5	11	...
XIX.	Dunrobin Castle ...	1·18	— 1·44	·20	28	13	52·0	18, 22	26·5	25	15	...
,,	Castletown ...	1·86	...	·47	14	22	48·0	18*a*	26·0	25	15	...
XX.	Killarney ...	8·53	+ 2·88	1·22	3	24	53·0	13	33·0	26	0	...
,,	Waterford (Brook Lodge)...	4·97	+ 1·45	·93	2	21	51·5	7	28·6	22	7	...
,,	Broadford (Hurdlestown) ...	3·90	+ ·77	·46	9	26	46·0	7	26·0	31	5	...
XXI.	Carlow (Browne's Hill) ...	4·01	+ ·94	·67	4	23	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	2·54	+ ·40	·55	3	19	54·8	27	31·5	16	3	11
XXII.	Ballinasloe ...	4·03	+ ·59	·49	13	27	58·5	26	27·0	1, 31	14	...
,,	Clifden (Kylemore House)..	9·95	+ 1·98	1·58	6	23	...	...	...	...	...	...
XXIII.	Seaforde ...	3·05	— ·36	·58	3	18	50·0	18, 19	...	...	11	12
,,	Londonderry (Creggan Res.)	5·22	+ 1·56	·69	9	25	...	...	...	...	...	...
,,	Omagh (Edenfel) ...	4·64	+ 1·13	·60	12	23	50·0	26	28·0	30	12	21

+ *Shows that the fall was above the average*; — that it was below it. *a* and 22nd, 23rd.

SUPPLEMENTARY RAINFALL, JANUARY, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	5·20	XI.	New Radnor, Ednol	5·07
,,	Sheppey, Leysdown	2·65	,,	Rhayader, Nantgwillt	8·57
,,	Hailsham	5·45	,,	Lake Vyrnwy	6·04
,,	Crowborough	5·96	,,	Ruthin, Plâs Drâw	3·18
,,	Ryde, Beldornie Tower	...	,,	Criccieth, Talarvor	3·53
,,	Emsworth, Redlands	4·10	,,	Anglesey, Lligwy	4·65
,,	Alton, Ashdell	6·10	,,	Douglas, Woodville	3·10
,,	Newbury, Welford Park	4·55	XII.	Stoneykirk, Ardwell House	2·97
III.	Harrow Weald	2·85	,,	Dalry, Old Garroch	6·43
,,	Oxford, Magdalen College	2·84	,,	Langholm, Drove Road	5·13
,,	Banbury, Bloxham	3·17	,,	Moniaive, Maxwelton House	4·66
,,	Pitsford, Sedgebrook	2·41	,,	Lilliesleaf, Riddell	2·96
,,	Huntingdon, Brampton	1·81	XIII.	N. Esk Reservoir [Penicuick]	3·25
,,	Wisbech, Bank House	1·47	XIV.	Maybole, Knockdon Farm	3·29
IV.	Southend	2·22	,,	Glasgow, Queen's Park	...
,,	Colchester, Lexden	2·14	XV.	Inveraray, Newtown	6·69
,,	Saffron Waldon, Newport	2·13	,,	Ballachulish, Ardsheal	11·47
,,	Rendlesham Hall	1·86	,,	Campbeltown, Redknowe	4·85
,,	Swaffham	1·80	,,	Islay, Eallabus	5·82
,,	Blakeney	1·27	XVI.	Dollar	2·93
V.	Bishop's Cannings	3·54	,,	Balquhidder, Stronvar	8·40
,,	Ashburton, Druid House	9·17	,,	Coupar Angus Station	2·07
,,	Okehampton, Oaklands	7·27	,,	Blair Atholl	3·39
,,	Hartland Abbey	5·16	,,	Montrose, Sunnyside	2·19
,,	Lynmouth, Rock House	6·02	XVII.	Alford, Lynturk Manse	1·28
,,	Probus, Lamellyn	5·93	,,	Keith, H.R.S.	1·27
,,	Wellington, The Avenue	4·00	XVIII.	Fearn, Lower Pitkerrie	...
,,	North Cadbury Rectory	3·40	,,	S. Uist, Askernish	4·60
VI.	Clifton, Pembroke Road	3·58	,,	Invergarry	8·55
,,	Moreton-in-Marsh, Longboro'	3·55	,,	Aviemore, Alvie Manse	2·10
,,	Rosa, The Graig	3·10	,,	Loch Ness, Drumnadrochit	3·61
,,	Shifnal, Hatton Grange	2·80	XIX.	Invershin	1·64
,,	Wem Rectory	2·52	,,	Altnaharra	3·21
,,	Cheadle, The Heath House	2·56	,,	Bettyhill	2·60
,,	Coventry, Kingswood	2·71	,,	Watten, H.R.S.	1·34
VII.	Market Overton	2·75	XX.	Cork, Wellesley Terrace	5·30
,,	Market Rasen	1·67	,,	Darrynane Abbey	7·08
,,	Worksop, Hodsock Priory	1·96	,,	Glenam [Clonmell]	5·54
VIII.	Neston, Hinderton	2·15	,,	Ballingarry, Hazelfort	3·61
,,	Southport, Hesketh Park	2·86	,,	Miltown Malbay	5·69
,,	Chatburn, Middlewood	3·75	XXI.	Gorey, Courtown House	3·82
,,	Duddon Valley, Seathwaite Vic.	10·65	,,	Moynalty, Westland	3·95
IX.	Langsett Moor, Up. Midhope	5·14	,,	Athlone, Twyford	3·37
,,	Baldersby	2·52	,,	Mullingar, Belvedere	3·44
,,	Scalby, Silverdale	2·54	XXII.	Woodlawn	4·23
,,	Ingleby Greenhow Vicarage	2·69	,,	Westport, Murrisk Abbey	7·42
,,	Middleton, Mickleton	2·56	,,	Crossmolina, Enniscoe	6·53
X.	Beltingham	2·54	,,	Collooney, Markree Obsy	4·63
,,	Bamburgh	1·79	XXIII.	Enniskillen, Portora	3·56
,,	Keswick, The Bank	7·14	,,	Warrenpoint	3·55
,,	Melmerby Rectory	3·70	,,	Banbridge, Milltown	2·80
XI.	Llanfrechfa Grange	6·19	,,	Belfast, Springfield	3·45
,,	Treherbert, Tyn-y-waun	13·49	,,	Bushmills, Dundarave	4·12
,,	Llandovery, Tonn	5·47	,,	Stewartstown	3·53
,,	Castle Malgwyn	6·48	,,	Killybegs	5·32
,,	Llandefaelog-fach	5·27	,,	Horn Head	5·22

METEOROLOGICAL NOTES ON JANUARY, 1904.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm R for Rain; H for Hail; S for Snow.

ENGLAND.

London, Camden Square.—Very little relief was experienced from the gloomy and ungenial conditions which prevailed in December, and dark, damp weather continued almost throughout, with temperature nearly always above the average. Measurable R fell on 26 days and the total duration was 79·5 hours, whilst the duration of sunshine reached only 20·5 hours. Mean temp. 39°·5, or 1°·4 above the average.

Tenterden.—The first half was warm and showery, and the end very wet, but it was colder from 15th to 26th, with alternate frost and thaw. TS and violent gale from 1.35 to 2.35 a.m. on 14th. Duration of sunshine 38 hours.

Sheppey, Leysdown.—A mild, rainy month, with much wind from 7th to 14th. Sharp TS on the early morning of 13th. The temp. was below 32° all day only on 1st and 24th.

Crowborough.—A wet, gloomy month, with R considerably in excess of the average and the greatest in January since 1877. Frost occurred on 11 days. T and L on 31st and S and H. Mean temp. 37°·4.

Hartley Wintney.—A black January. The weather was varied, cloud and gloom prevailing. Slight frost in the first and third weeks. Distant TS on 13th and L on 13th, 14th and 15th. Ozone on 18 days with a mean of 4·4.

Winslow, Addington.—A very disheartening month for all employed on the land, the ground being in a complete state of saturation.

Pitsford, Sedgebrook.—A cold, wet, dull and wretched month. R ·75 in. above the average of 10 years. Mean temp. 37°·6.

Norwich, Brundall.—Dull and damp, with mean temp, 1°·0 above the average. The seventh mild January in succession.

Winterborne Steepleton.—R nearly double the average of 11 years, and mean temp. nearly 1°·0 above the average.

Torquay, Cary Green.—R 2·31 in. above the average. Mean temp. 44°·1, or 1°·3 above the average. Duration of sunshine 53 4 hours, or 8·5 hours below the average. Mean amount of ozone 4·6; max. 8·0 on 15th and 27th, min. 1·0.

Ashburton, Druid House.—Heavy R at times, and cold with H and S in the middle of the month, preceded by T and L on 13th.

North Cadbury Rectory.—No S and little frost. The pond was higher than ever seen before; the ground saturated and all farm work stopped.

Clifton, Pembroke Road.—Wet and mild, except a week of dry weather with frost and high bar. from 18th to 25th. T, L and H at 8·45 p.m. on 13th.

Ross, The Graig.—The temp. was above the average both by day and night, and the number and severity of frosts were less than usual. The R was somewhat more than the average and the number of rainy days much more. Gloomy and cloudy, and the meadows almost always saturated with water.

Worksop, Hodsock Priory.—Dull and mild, with no S or sharp frost.

Bolton, The Park.—Dull, with 22 days absolutely without sunshine, whilst the mean relative humidity, 93, was the highest on record. Mean temp. 38° 6, or 0·6 above the average. Duration of sunshine 11·5 hours, or 9·5 hours below the average. Slight S occurred on 3 days.

Southport, Hesketh Park.—Humid and rather mild, with low bar. and a deficiency of sunshine, the total duration being 10 hours below the average and the mean temp. 1°·2 above the average. The total R was only ·17 in. above the average. Gales on 7 days. Fogs on 10 days. Ice on lake on 7 days.

Seathwaite Vicarage.—Uniformly mild and almost continuously wet with but one slight fall of S on 15th.

Hull, Pearson Park.—Extremely dull and sunless, with frequent fog or mist, and periods of cold with H on 10th and sleet on 2nd. Gale on 14th.

Bamburgh.—As a whole very mild with light and moderate winds. Slight frost, no S, and little fog. Not at all seasonable.

WALES AND THE ISLANDS.

LLANFRECHFA GRANGE.—Mild, with very little frost and much fog and mist.

LLANDOVERY.—An unusually large number of wet days and frequency of stormy weather. Mean shade temp. 39°·8. Prevailing wind S.W.

HAVERFORDWEST.—Cold, dry and cloudy, with S.E. wind to 3rd, after which a cold, wet period set in lasting more or less till the 20th. Finer and drier to 26th, and from that date to the end alternate frosty nights and rainy days. Stormy from 12th to 15th. Duration of bright sunshine 31·6 hours.

ABERYSTWITH, GOGERDDAN.—Very mild, with little frost, a great deal of R and no S. Great storm on the evening of 13th, with wind chiefly N.W. and S.W.

DOUGLAS, WOODVILLE.—R below, and temp. generally above, the average, and unusual number of fine and even sunny days, but much stormy weather and some three violent gales Slight S fell on 2 days, H on 4, and there was much L on 12th and 13th. Many spring flowers were already in bloom.

SCOTLAND.

MONIAIVE, MAXWELTON HOUSE.—Wet and cold but not severe, except from 16th to 25th, when it was dry. A little S on 25th and 31st, but no heavy fall.

LILLIESLEAF, RIDDELL.—Wind high and continually W. or S.W. The temp. kept round freezing point. No S.

INVERARAY, NEWTOWN.—Mild, unsettled and rainy.

BALLACHULISH, ARDSHEAL.—Mild and wet. R 4·46 in. above the average.

MULL, QUINISH.—Sharp frost for the first few days. Thereafter mild and very wet, with short and sudden gales from S. to S.W.

COUPAR ANGUS.—Wet days above, but R slightly below, the average. Mean temp., 37°·1, was 1°·7 above the average.

ABERDEEN, CRANFORD.—Wet with overcast sky and few bright days, but very little S. Light wind from S., S.W. and W.

LYNTURK MANSE.—The last fortnight was specially fine for the season. Very little S for the month.

DRUMNADROCHIT.—R ·15 in. below, but rainy days 1 above, the average. Distant T on 10th whilst S was falling.

GOLSPIE, DUNROBIN CASTLE.—Fairly open and suitable for outdoor operations, though changeable.

ALTNAHARRA.—Very fair and open, and though generally very cold, there were some exceptionally mild days.

CASTLETOWN.—Fresh open weather. S.E. to S.W. winds in the first part, with frosty nights. On 14th the bar. fell to 28·55 in., and on 15th and 16th there was a strong N.W. gale. In the latter part N.W., W. and S. winds.

IRELAND.

CORK, WELLESLEY TERRACE.—R 1·30 in. over the average. Anti-cyclone on 27th, accompanied by high bar., calm and dry atmosphere and fog. Great storm from S.W. on 29th. Sleet and some S on 31st. T and L on 4th and 27th.

MILTOWN MALBAY.—Generally cold and stormy, with much T, L, and H, except one mild week from 16th to 23rd, with sea-fog and mist. Although it was boisterous and squally, there was no great storm.

DUBLIN, FITZWILLIAM SQUARE.—An open, dull, damp month, with frequent R. The mean temp. was 42°·6, or 1°·0 above the average of 30 years.

COLLOONEY, MARKREE OBSERVATORY.—Although R fell on 27 days, the total was not above the average. Very mild throughout. Wind generally from S.E. to S.W. and W. with a few gales. H on 4 days, T on 1, L on 4, and fog on 2.

BELFAST, SPRINGFIELD.—An average January, and on the whole satisfactory, frost being rather prominent.

OMAGH, EDENFEL.—The first fortnight was very wet, raw and unsettled. A coldish and drier spell followed, with a return to wet and humid weather at the end. The temp. was above the average, and it could hardly be said that the ground was once covered with S, so short was its duration.

Climatological Table for the British Empire, August, 1903.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	80·6	8	45·4	11	70·1	52·4	52·2	75	125·3	41·4	4·24	18	5·4
Malta	96·3	14	63·5	17*a*	87·5	68·4	66·5	71	145·3	58·2	·00	0	0·6
Lagos, W. Africa	84·1	27	70·6	13	81·2	73·1	70·7	78	144·0	68·0	·69	13	...
Cape Town	77·2	21	39·8	20	62·2	46·2	46·2	74	...	...	3·22	14	4·4
Durban, Natal	84·2	7	49·2	19	76·6	56·7	...	...	133·6	...	1·85	7	3·3
Mauritius	78·7	1	56·3	22	75·9	62·3	58·7	71	141·1	49·0	1·77	19	6·5
Calcutta	90·3	5	74·8	8	87·9	78·4	77·8	86	156·2	73·6	10·17	17	8·7
Bombay	87·1	17	74·1	21	84·4	77·5	76·1	86	140·7	73·2	18·23	26	8·3
Madras	100·5	4	72·9	17	92·9	77·2	74·0	77	142·8	72·0	7·88	14	6·3
Kodaikanal	65·4	8, 10	50·4	10	62·3	52·4	51·8	86	144·6	42·1	12·94	19	7·9
Colombo, Ceylon	90·5	21	71·6	11	87·0	77·1	72·3	78	146·3	70·0	7·54	18	6·7
Hongkong	91·2	1	73·1	17	85·8	77·1	75·8	85	142·7	...	14·97	21	6·9
Melbourne	67·8	31	30·3	29	55·2	41·1	40·7	72	127·8	23·5	·48	8	5·4
Adelaide	70·0	9	37·7	6	53·8	45·4	43·5	71	126·7	29·6	2·34	14	5·3
Coolgardie	76·2	22	34·4	3	65·0	42·6	40·7	61	144·2	27·6	·65	4	3·6
Sydney	70·0	11	42·9	13	60·3	47·4	42·8	75	98·0	31·9	5·16	16	4·7
Wellington	62·7	12	31·0	2	51·6	40·7	39·6	79	108·0	21·0	9·88	23	6·7
Auckland	61·0	10	38·5	4	56·3	46·4	42·3	72	120·0	35·5	3 37	20	6·1
Jamaica, Negril Point	92·1	10	69·7	29	87·0	73·6	71·1	81	...	...	11·25	21	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	88·2	4	72·0	28	84·1	74·7	71·9	78	147·0	...	14·59	27	4·3
Toronto	83·0	6	46·9	1	72·1	55·4	55·9	77	101·2	42·9	3·65	11	6·0
St. John's, N.B.	77·7	22	38·0	29	70·9	47·4	48·8	59	...	...	3·18	12	4·9
Winnipeg	83·0	31	37·0	8	72·5	49·8	...	...	...	...	2·00	15	5·6
Victoria, B.C.	73·7	17	43·2	31	66·4	52·7	...	...	...	...	1·06	8	5·6
Dawson	...	...	...	...	...	...	...	...	...	...	...	...	...

a and 18.

MALTA.—Mean temp. of air 1°·2 below, dew point 0°·4 and R ·08 in. below averages. Mean hourly velocity of wind 6·7 miles, or 0·6 below average. Mean temp. of sea 79°·4.

LAGOS, W. AFRICA.—Mean hourly velocity of wind 9 miles.

Mauritius.—Mean temp. of air 0°·4 above, dew point 0°·8 above and R ·58 in., below averages. Mean hourly velocity of wind 12·5 miles, or 0·2 below average; extremes, 30·8 on 18th and 1·7 on 21st; prevailing direction E.S.E.

MADRAS.—T88 on 8 days. Bright sunshine 136·1 hours.

KODAIKANAL.—Mean temp. of air 56°·0. Mean velocity of wind 323 miles per day. Bright sunshine 95·5 hours.

COLOMBO, CEYLON.—Mean temp. of air 81°·2 or 0°·5 above, of dew point 0°·9 below and R 3·88 in. above averages. Mean hourly velocity of wind 8·6 miles, prevailing direction S.W. T88 on 4 days.

HONGKONG.—Mean temp. of air 80°·9. Sunshine 158 hours. Mean hourly velocity of wind 8·7 miles.

Sydney.—Mean temp. of air 0°·9 below, humidity 1·4, and R 1·90 in. above, averages.

Wellington.—Mean temp. of air 2°·3 below, and R 4·68 in. above, averages.

Auckland.—Mean temp. of air 1°·0, and R nearly one inch below averages.

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THE DAWSON-LANDER SUNSHINE RECORDER.

In our very brief notice of this instrument when describing the Meteorological Exhibition at Southport we inadvertently did less than justice to a very ingenious piece of apparatus, and we are now glad to give a fuller account of it. The recorder is very compact, strongly and neatly made and the whole measures only 4 inches in diameter. The instrument consists of a fixed drum, on which a piece of silver chloride photographic printing paper is fixed under a film of transparent celluloid. A light-tight outer cover is rotated by a clock once in 24 hours and a very narrow slit is thereby always directed towards the sun. A funnel-shaped hood protects the slit from diffused light and allows of an error of about half-an-hour in the clock before the direct sunlight is cut off from the slit. The general external appearance is shown in Fig. 1. By an ingenious device the drum carrying the sensitive paper is made to travel (without rotation) along the axis of the cylinder, so that the records of a number of days may be obtained one below the other. We reproduce in Fig. 2 a whole month's record.

Fig. 1.—The Dawson-Lander Sunshine Recorder.

The advantages of the instrument are obvious. The use of chloride of silver paper makes it possible to have a standard of intensity of sunshine which can readily be reproduced, thereby distinguishing it from other photographic recorders, which depend on the fickle ferro-prussiate paper. The same size of paper is used at all times of the year and the instrument is as serviceable for the twenty-four hours sunshine of the polar regions as for temperate latitudes. The disadvantage is that if the clock is not correctly set, no record can be

obtained, but we understand that there is no practical difficulty on that account. A more difficult question is likely to be the selection of the exact shade of intensity of the print which is to be measured as bright sunshine. Here the very perfection of the record, which faithfully sets down the intensity as well as the duration of sunlight, is almost a drawback. By narrowing the slit to one-hundredth of an inch the inventors state that the amount of sunshine recorded is the same as that obtained by the Campbell-Stokes instrument.

The Dawson-Lander sunshine recorder is made by Messrs. Lander and Smith, of Canterbury.

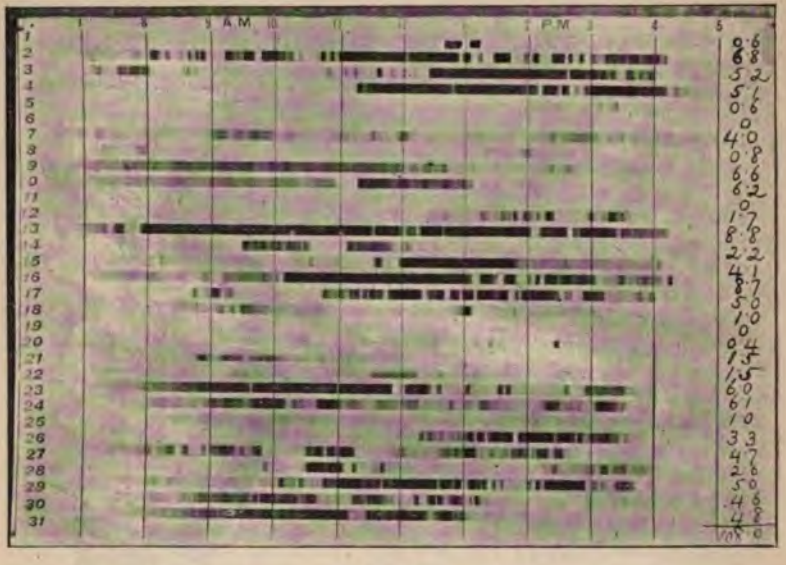

Fig. 2.—Specimen of the Record of the Dawson-Lander Sunshine Recorder.

FIVE MONTHS' WINTER RAINFALL.

The Table compares the total rainfall of the five months of the winter half-year with the average; the first column of figures gives the number of inches at each station in excess (+) or in defect (—) of the average, and in the second column the total amount of rain is given as a ratio taking the average as 100. It will be remembered that November and December, 1903, were months of small rainfall, the amount being considerably below the average in almost all parts of the country. October, 1903, was however an exceptionally wet month; and the two months of 1904 which have passed have also been very wet in most parts of the country.

October, 1903—February, 1904.

Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	4·17	142	Arncliffe ...+	5·51	118	Braemar ...—	·64	96
Tenterden .....+	4·01	135	Hull .....+	·96	109	Aberdeen ...+	2·68	118
Hartl'yW'ntn'y+	7·48	167	Newcastle...+	6·69	161	Cawdor .....—	·41	97
Hitchin .....+	4·73	147	Seathwaite +	2·88	104	Glencarron —	2·85	94
Winslow .....+	4·75	146	Cardiff .....+	11·13	159	Dunrobin ...+	·72	105
Westley .....+	2·74	126	Haverf'dwest+	7·56	133	Darrynane +	4·88	120
Brundall.....+	1·69	116	Gogerddan +	8·24	137	Waterford +	8·17	146
Alderbury .....+	9·10	168	Llandudno +	3·79	126	Broadford..+	7·28	149
Ashburton .....+	14·20	151	Dumfries ...+	2·74	112	Carlow .....+	1·93	112
Polapit Tamar +	15·09	184	Lilliesleaf ...+	4·30	132	Dublin .....+	·15	101
Stroud .....+	6·68	156	Colmonell ...+	5·45	125	Mullingar...+	2·92	119
Woolstaston ...+	6·08	146	Glasgow ...+	2·29	113	Ballinasloe +	3·07	119
Boston .....+	3·81	145	Inveraray ...+	2·24	106	Clifden .. ...+	4·05	111
Hesley Hall ...+	2·63	128	Islay .....+	5·44	123	Crossmolina +	5·69	121
Derby.....+	4·04	143	Mull .....+	6·76	124	Seaforde ...+	4·44	126
Bolton .....+	6·75	139	Loch Leven +	1·13	107	Londonderry+	3·06	117
Wetherby .....+	7·79	180	Dundee .....+	1·71	113	Omagh .....+	6·93	139

The winter has been a dry one only in the north of Scotland, where there is a considerable area stretching from Braemar through Inverness to Glencarron in which the rainfall of the five months was below the average. No other part of the country has been so favoured. Except for small patches in the south of Scotland and in the east of Ireland, the whole of the northern kingdom and the sister isle have had an excess of rainfall decidedly less than 25 per cent., and thus cannot seriously complain of a wet winter.

In England, on the other hand, only the Lake District and a narrow strip on the east coast have had so small an excess as 25 per cent., a stretch of country in the east of Northumberland, Durham and Yorkshire, had an excess greater than 50 per cent., and one station showed as much as 80 per cent. The south-east of Wales and the whole of south-western England, including the counties Cornwall, Devon, Somerset, Gloucester, Dorset, Wilts, Hants, Berks, Oxford and Worcester, had also an extremely wet winter, the excess exceeding 50 per cent. This means that the average amount of rain for the period had fallen and, at least, half as much more. At one station on the boundary line between Cornwall and Devon, the excess reached the remarkable amount of 84 per cent.

The Tables on pp. 36-37 show how the heavy rains of February were distributed. During that month the north-east of Scotland was remarkably dry; but a very large part of our islands had more than four inches of rain, the greater part of Cornwall, Devon and Wales, having more than six inches. London was comparatively dry, and the east of England had little to complain of so far as moisture is concerned, though cloudy skies and low temperatures made the month far from pleasant in its weather.

METEOROLOGICAL OBSERVATIONS OBTAINED BY THE USE OF KITES, OFF THE WEST COAST OF SCOTLAND, 1902.

A PAPER embodying the results of the kite experiments made by Mr. Dines off the west coast of Scotland during July and August, 1902, was read before the Royal Society on May 14th, 1903, by Dr. W. N. Shaw, F.R.S., and Mr. Dines. It is published in the *Philosophical Transactions*, Series A, Vol. 202, pp. 123—141. A description of the instruments used, and a tabular statement of the results of each ascent, as laid before the British Association in September, 1902, was given in this Magazine for October, 1902. In the present paper the results were presented graphically in the form of a diagram, representing the height in the air of a series of temperature at successive intervals of 1° C. for each ascent. For purposes of comparison the barometer curves at Fort William and Ben Nevis, and some particulars of the dry and wet bulb temperatures, are printed on the same diagram.

The average fall of temperature for each 500 metres of ascent was found to be as follows :—

	July.			August.		
0 to 500 metres,	22	ascents,	3°·0 C.	13	ascents,	2°·6 C.
500 ,, 1000 ,,	16	,,	2°·8	11	,,	2°·8
1000 ,, 1500 ,,	9	,,	2°·2	9	,,	2°·3
1500 ,, 2000 ,,	2	,,	2°·0	7	,,	2°·1
2000 ,, 2500 ,,	1	,,	2°·0	3	,,	2°·0
2500 ,, 3000 ,,	...		...	2	,,	2°·0
3000 ,, 3500 ,,	...		...	2	,,	1°·7

It was shown that on the approach of a barometric depression the temperature gradients diminish on the average by as much as 50 per cent., and the paths of the depressions which produced the changes are also shown on maps.

The average value of the temperature gradient per 100 metres at different heights varies from 0°·56 C. in a column of 500 metres to 0°·43 at 3500 metres, and the average differs very slightly from that given in Hann's "*Meteorologie*," or from the conventional figure in common use. It was pointed out that a moderately strong wind was required for the higher ascents, and that the values obtained at great altitudes therefore refer to a more or less special type of weather.

Comparisons between the temperature observed at Ben Nevis and that in the free air at the same altitude showed that the latter are on the average 2°·6 higher, a result apparently due to the mechanical action of the sides of the mountain itself in causing an upward flow.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday evening, February 17th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

The following gentlemen were elected Fellows of the Society: Rev. W. C. Eppstein, M.A., Mr. T. Green, Mr. N. V. Iyya, Mr. W. Matern, and Mr. T. Edmondston Saxby, L.R.C.S.

Mr. E. Mawley read his "Report on the Phenological Observations for 1903." He stated that, taken as a whole, the year had been warm, very wet, and sunless. As affecting vegetation the most noteworthy meteorological features were the severity of the April frosts; the three weeks of dry, warm and sunny weather which occurred towards the middle of an otherwise cold, rainy and gloomy summer; and the excessive and persistent rainfall in October. Owing to the mildness of the winter and early spring wild plants flowered in advance of their average dates until about May, after which time only backward dates were recorded. In no previous year since the present series of reports was first instituted in 1891 have such spring migrants as the swallow, cuckoo and nightingale been so late in reaching our shores. The yield of wheat, barley, potatoes, turnips and swedes were somewhat under the average, but all the other farm crops yielded well, especially those of hay and beans, which were unusually abundant. On account of the wet and protracted harvest most of the grain of the cereals was more or less discoloured, while potatoes were almost everywhere much diseased. Throughout the country this was one of the most disastrous years for fruit ever known. In fact, the only fruit crop which gave anything like an average yield was that of strawberries.

An interesting discussion followed the reading of this report, in which the President, Mr. F. Campbell Bayard, Mr. C. Harding, Mr. A. Brewin, Mr. Baldwin Latham, Mr. F. Druce, Mr. W. B. Tripp, Mr. R. H. Curtis, Mr. J. E. Clark, Mr. J. Hopkinson, and Dr. H. R. Mill took part, and Mr. E. Mawley replied.

Mr. W. H. Dines read a paper on "Observations by means of kites at Crinan in the summer of 1903." These observations were carried out by Mr. Dines under the auspices of a joint Committee of the Royal Meteorological Society and of the British Association, the Government Grant Committee of the Royal Society providing funds for the hire of a vessel for the purpose. The author, after describing various improvements which he had effected in the kites, stated that the weather last summer was most unfavourable for kite flying, as not only was there heavy rainfall, but gales were of frequent occurrence. Repeatedly a kite was carried up a thousand feet or more in a few minutes, or dropped the same height by a convection current. On August 20th a thunderstorm came on suddenly when

the kite was at a considerable altitude. Mr. Dines's account of this storm is as follows:—

"I should not deliberately send up a kite during a thunder-storm, and was therefore the more pleased, when accidentally surprised by one, to recover the instruments safely. There is, however, nothing in any way peculiar about the chart, the temperature gradient being close to its average value. The kite when the first flash of lightning occurred was at a height of 4550 ft., 8230 ft. of wire being out, and we had little expectation of getting it back. Full steam was turned on, and the engine left to pull in the wire as fast as it could, since electrical indications could decidedly be felt by any one touching the steam valve. During the winding in, what at first appeared to be a squall overtook the vessel, the appearance being that of a definite wall, behind which nothing could be seen except the white tops of a few breaking waves. It was, however, only rain and hail, and mist, produced by the splashing of the rain and hail on the sea. As it passed the vessel the water ran down the deck in sheets, and I do not think I have ever seen rain of such intensity. Some difficulty was experienced with the kite when it was near the vessel, owing to the fitful character of the wind, which several times dropped entirely, and allowed the wire to become slack. No hail occurred at Crinan, some five miles to the north-east, but thunder and very heavy rain. The thunder was not of a severe character or very frequent, but there were several flashes of lightning less than a mile distant. The chart shows that rain of an exceptional character and hail may occur under normal conditions of temperature gradient near the surface. It would have been interesting to have had records from the higher strata."

The results of the observations show that in August 1903 the mean temperature gradient for the first 5000 feet was 3°·2 per 1000 feet. This is substantially the same as that obtained during the preceding summer although the conditions of weather were different.

The President, Dr. W. N. Shaw, Mr. J. Hopkinson, Dr. R. H. Scott, Mr. J. E. Clark, and Mr. W. Marriott took part in the discussion on this paper, and Mr. Dines replied.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

ATMOSPHERIC PRESSURE AND CLIMATE.

I WAS much interested in reading the article by Mr. Bonacina in the February number, and fully agree with him as to the important influence that the position of the isobars has upon climate, but I should prefer to put the statement in the form "prevailing winds" instead of "isobars," although of course if we know one we can infer the other. I should like, however, to ask his authority for the supposition that if the conditions were anticyclonic the mean temperature of January at Greenwich would be 20° F. instead of 37°. Unless "anticyclonic" is to be taken as meaning a north-easterly wind, a meaning that I think it often incorrectly bears, the supposition is not at all in accordance with observational results. As a general rule if a frost in the south of England is of exceptional length and severity it is accompanied by a barometer below the mean (*Quarterly Journal R. Met. Soc.*, Vol. **23**, page 239); also, the mean temperature of the days at Greenwich in the winter on which the barometer is much above its usual level—viz., above 30·20 in.—comes out for the 50 years 1841—1890 as 38·3 F., a value close to the mean. (*Quarterly Journal R. Met. Soc.* Vol. **25**, page 33.) These facts, and that they are facts any one who will take the trouble may verify for himself, are utterly antagonistic to the idea that anticyclonic conditions are accompanied by exceptional cold in the British Isles. No doubt an anticyclone situated over Scandinavia or Iceland produces cold in England, and an anticyclone over France or Spain produces warmth; but I see no reason why the one condition rather than the other should be described as anticyclonic conditions over the British Isles.

W. H. DINES.

THE STUDY OF SUNSPOT CYCLES.

I HAVE read Mr. H. H. Clayton's letter and 11-year sunspot cycle scheme with interest. The criticisms as to the maxima and year-joining I agree with after more application of the table. The former differ for the reason indicated rather than expressly said in my foot note. I took the years with "unsmoothed" maxima for the months August—October, on which I was mainly working. But I conclude now that, though this and the extra year-joining were more accurate in theory, they are not needed in practice, and in any fresh investigation I should use the simpler series and the "smoothed" maxima and minima that apply to the whole year.

J. EDMUND CLARK.

SNOW FALLS EIGHTY YEARS AGO.

WITH regard to the severe winters of eighty years ago, you may like to make a note of some records in our Sturminster Marshall Churchwarden's books. I may say that the Church consists of nave and north aisle. The snow would accumulate in the valley between the two roofs.

1820. Jan. 7.—Wm. Cox and F. Everett.
Throwing snow off the Church, 2 days each ... 8s.
Dec. 23. do. do. 6s.
1823. March 25.—Throwing snow, &c. ... ... 4s.

Perhaps other churchwardens' books might give information of bygone years before rain gauges.

I may say that in the last 25 years we have only had snow thrown off about once or twice, and the sexton has done that as part of his ordinary work, so I imagine these must have been very heavy falls.

JAMES CROSS.

Bailie House, Wimborne, 18th Feb., 1904.

THUNDERSTORM AT BROUGHTON-IN-FURNESS, February 12th, 1904.

REAL thunderstorms so rarely occur near this station that a short account of one that occurred on February 12th may be of interest.

Clouds gathered towards 10 p.m., and for an hour or more after that there were pretty frequent flashes of vivid reflected lightning, which lit up most strongly the low hills to the S.E., over which they seemed to play. About 11.35 p.m. some loud peals of thunder were heard, having a very peculiar rolling and continuous sound for 30 seconds or more at a time, with very short intervals between the peals; a few fitful gusts of wind sprang up about this time and died away again after blowing for a minute or two. About 11.45 p.m. a strange hissing and rushing sound of wind was heard in the distance to the S., lasting for a minute or two and increasing in intensity and volume as the wind apparently came nearer. This sound was sufficiently peculiar to arrest the attention of all who heard it. Perhaps it was due to falling hail. Then, all at once, with terrific fury the storm was on us: blinding flashes of lightning, crashing peals of thunder, and hailstones beating on the glass with such violence that one could scarcely be heard when speaking; this continued incessantly for twelve minutes or so, then the storm died away as quickly as it had arisen, and in ten more minutes all was calm and still.

CHAS. P. CHAMBERS.

Orchard Head, Broughton-in-Furness.

OBSERVATIONS OF RAIN AND DUST AND EVAPORATION, EDINBURGH, 1903.

I SEND for your inspection monthly tables of rain and dust and soot fall for Edinburgh central district for 1903, with that of evaporation also deduced from observations by a 6 in. gauge in back garden. The fall of dust and soot was registered by an open dish or gauge of 74 square inches area, or 8½ inches square, and amounted to 17 ounces for the year, giving 32 oz. per square foot. This considerable increase of dust fall for 1903 over that of 1902, when it was only 2 oz. for 8½ in. gauge, consisted mostly of sand blown from the building operations carried on at the girls' school in George Square, and at the extension works of the University Union building, by south-westerly, westerly and north-westerly winds blowing across the garden. The rainfall was much greater than usual, nearly double that of 1902, or 30·032 in. compared with 16·227 in., owing to wintry weather in January, February and March, to summer rains in July and August, and equinoctial gales in September and October. The number of rainy days was 218, compared with 179 in 1902, owing to like occurrences.

As might have been expected, the amount of evaporation for 1903 was much decreased from that of 1902, or 11·970 in. from 13·540 in., due to the general cloudy weather prevailing, and the absence of sun's heat during the general wet state of the whole year.

A curious contrast between the rainfall and evaporation of common observation in small and large gauges is, that the small evaporators register more reduction in the water than the large ones, and that the large rain gauges register more increase in the rainfall than the small ones—in fact, just the opposite.

Rain gauges, in pursuance of these observations, would require to be not below a certain moderate area, and if too small in the mouth they would register less rain than naturally falls to the earth.

So in the case of evaporation ; a small gauge is less objectionable for registering than a large one, but this regular action is liable to be influenced besides by material of construction, as one of glass evaporates much less water than one of metal.

W. G. BLACK, F.R.Met.Soc.

2, George Square, Edinburgh.

[The measurement of evaporation in small vessels containing a shallow layer of water is, we fear, too largely dependent on the material of which the vessel is composed to give results of great value. The experiments on evaporation, recorded from year to year in "British Rainfall," have shown the necessity of using large tanks so as to avoid the complications due to local heating, and the standard size, 6 feet square and 2 feet deep, seems to have secured this result.—ED. *S.M.M.*]

LOW MAXIMUM TEMPERATURES.

THE winter which has just come to an end has been, meteorologically speaking, very commonplace; but it possessed one feature which was somewhat unusual, especially as the mean temperature (39°·1) was above the average (38°·6) for the last twenty years, for this locality; namely, the remarkable absence of high maximum temperatures.

The average number of days in winter, for the last twenty years, on which the *maxima* have touched 50° is 18·5; whereas for the winter just over, there were only seven days on which 50° was reached, viz. :—one day in December, and three each in January and February.

There have only been two winters during the past twenty years in which there have been fewer maxima of 50°, namely, 1887-8 with five days, and 1885-6 with four, even the very severe winters of 1894-5 and 1890-1 had respectively eight and nine, while 1893-9 had forty-four, 1902-3 thirty-four, 1897-8 twenty-six, and 1900-1 twenty-four days with maxima of 50° and upwards.

Is it not probable that the saturated condition of the soil, owing to the abnormally heavy rainfall of the past fourteen months, may be the cause of the absence of high maxima during a winter which in every other respect must be characterized as having been a mild one?

H. K. S. ROGERS.

26, Charlton Road, Blackheath, S.E., 6th March, 1904.

GRADUATION OF RAIN GLASSES.

Now that our rain gauges are in such unceasing use, may I trespass upon your space to make a suggestion.

It is that it would be of much help to observers if the meteorological instrument makers would slightly alter the form in which the scale of the measuring glasses is at present engraved.

As now inscribed on the glass a very careful scrutiny is necessary, and the reading has often to be checked both upwards and downwards. If on the *left* hand of the vertical scale the fives were distinctly shown by a side line of half-an-inch (ordinary measure)—say, for example, the 15, 25, 35, and so on—the tens could be given in a somewhat similar manner and rather bolder on the *right* hand side of the scale—for example, the 20, 30, 40, etc. An additional safeguard against any error of level when the reading is taken might also be added, *viz.*, (without having a full double scale) a straight line (or dash stroke) engraved for each hundredth on the *opposite* side of the measuring glass, the "fives" and "tens" having longer strokes.

If this suggestion should seem feasible, and be endorsed by the weight of your approval, one might hope before long that our rain

glasses would be both quicker and more certain in being read accurately.

One would like to add how often it happens that the half-inch is very slightly exceeded—in which case a scale extended to 60 would be found very convenient. Beyond that it would be imprudent to go, for it might lead to greater chance of breakage of the slenderer and longer glass.

A Rainfall Observer of Over a Quarter of a Century.

[We shall be glad to have the opinion of observers on this subject.—Ed. *S.M.M.*]

REVIEWS.

Examen de la méthode de la prédiction du temps de [*Examination of the method of weather forecasts of*] M. N. Demtschinsky, par A. Klossovsky. Odessa, 1903. Size 9 × 6½. Pp. 74. Plates.

In this Magazine for May, 1901, (vol. **36**, p. 53), we applied the simple test of comparing the curves of temperature and pressure predicted by M. Demchinsky for Aberdeen and Valencia for April, 1901, with the curves showing the actual facts as they occurred, and we summed up our conclusions in the words, "practically the forecasts as a whole appear to us to be valueless." M. Demchinsky has continued to apply his theory of lunar action to the prediction of weather, and from his influential position in Russia as a personal friend of the Tsar his views have naturally attracted much attention and his predictions are regarded by many people as of great importance. In the memoir under review Professor Klossovsky of the University of Odessa has examined both the theories and the predictions of the clever Russian engineer with remarkable acuteness and erudition, and after an exhaustive discussion of the whole matter, with comparative curves of prediction and fulfilment for several stations, and for several years at each station, he sums up in a series of propositions, which we think English readers will be glad to see translated in full. It is pointed out that M. Demchinsky claims that on certain "nodal days" of the lunar year the curves of temperature of any number of lunar years cut each other at the same point—in other words, that the temperature on a "nodal day" is the same in every successive lunar year, however different the temperature of the various years may be on other days. He also claims that the climate of any particular season bears an ascertainable relation to the climate of the succeeding season at the same or at some other place.

Professor Klossovsky, on the other hand, says:—

1.—The verifications made for Odessa, Kieff and Moscow have not revealed any nodal days in the march of the curves of pressure, temperature, cloud or

rain. Consequently, the "ideal line" does not exist, unless it be the mean annual curve for the lunar year.

2.—The relation between the pressure and temperature of winter and summer holds good in fifty cases out of one hundred; in other words, it is equal to the probability of heads or tails turning up in pitch and toss. The process by which M. Demchinsky fills up the internodal parts of his thermal curves in winter and of the general march of the barometer remains unknown to us; and the same is true for the prediction of the other elements of climate.

3.—The law according to which certain days of "similar years" should have the same temperature is not justified even at Warsaw. The elements of weather have a very varied appearance in the course of "similar years," even in those which are separated by a cycle of 19 years.

4.—The formula of Tippenhauer and the application of it made by M. Demchinsky only reveal a succession of serious misunderstandings.

5.—The assertion that equal temperatures correspond to equal amounts of work is in complete contradiction to all the principles of modern science.

6.—All the predictions hitherto published have succeeded or failed according to the same probability by which heads or tails turn up in pitch and toss.

7.—M. Demchinsky's system in its entirety is without a single new idea, the deductions are based on the method of means, that of the earliest stage of meteorology.

Professor Klossovsky concludes by saying that if, after the proofs he has adduced, M. Demchinsky persists in his errors, he ought to submit his views to a special committee to be nominated by the International Meteorological Committee, and pending the decision of this tribunal, desist from publishing his predictions either in "Climat" or in the press.

Weather Folk-Lore and Local Weather Signs. Prepared under the direction of WILLIS L. MOORE by EDWARD B. GARRIOTT, Professor of Meteorology. Washington, 1903. Size 9 × 6. Pp. 154. Plates.

THE title of the book is English, not so the title of the author, for the British Isles do not boast a single professor of Meteorology, nor does the science receive with us more than a semi-contemptuous recognition in any seat of learning. The first part of this interesting memoir contains a selection of the weather-lore of all countries—most of which are familiar to us in Mr. Inwards' delightful collection—carefully arranged, with notes as to their applicability to the weather of the United States. Long range weather-forecasts in relation to sun-spot cycles and lunar influence are also referred to. Two-thirds of the book are occupied by summaries of local weather signs reported by the Weather Bureau observers. They deal with sequences of weather, relation of winds to rainfall and other conditions, periods of frost, &c. These must be of considerable utility to residents in the districts in question, but the utility is practically destroyed by the unscientific arrangement, which is alphabetical under the names

of towns. Suppose anyone were anxious to know the weather signs of the State of New York, he could only find them scattered amongst others under the names of Albany, Binghampton, Buffalo, Ithaca, New York, Oswego, and Rochester. For such a list a simple geographical arrangement of the data, with a key-map as well as an index of towns, ought unquestionably to have been adopted.

Magnetic and Meteorological Observations made by the "Southern Cross" Antarctic Expedition, 1898—1900, under the direction of C. E. Borchgrevink. London: Published by the Royal Society of London. 1902. Size 12 × 9. Pp. 112. Chart and Plates.

THE magnetic observations made by Mr. Bernacchi and Lieutenant Colbeck, both of whom are again in the Antarctic regions as members of the British expeditions, on board the "Discovery" and "Morning," have been reduced and discussed by Dr. Charles Chree, of Kew.

The meteorological observations were reduced, under the superintendence of Dr. W. N. Shaw, at the Meteorological Office, and they are furnished with an introduction and notes by Mr. Bernacchi. No doubt owing to the absence of the latter when the proofs were passed for press, the names of several of the members of the staff of the "Southern Cross" have suffered somewhat from the printer. Thus we read Dr. Herlof Klovstad, Mr. Nicolas Hanson, and Mr. A. Tongner, instead of Dr. Herluf Klövstad, Mr. Nicolai Hanson, and Mr. A. Fougner.

The observations are set out in detail as taken at two hourly intervals at the land station near Cape Adare (71°18′S., 170°9′30″E.), from March 3rd, 1899, to January 29th, 1900, and these are then summarised to show the mean monthly conditions. Monthly wind-roses are given, which show in a very striking way the preponderance of south-easterly winds on the shores of the Antarctic continent, and the almost entire absence of wind from points between north-west and south-west. This, combined with the records of earlier, and now of later expeditions also, proves that the zone of the Brave West Winds lies far to the north of Antarctica, and promises good results to any expedition which, breaking away from a tradition for which there is no justification, will attempt a circumnavigation from east to west in high latitudes. The question of Antarctic winds is discussed by Mr. Bernacchi, who gives interesting particulars of some of the terrific storms which frequently made the lives of the explorers miserable.

The meteorological log of the "Southern Cross" in Antarctic waters is given in a condensed form, and the volume is valuable as a record of data secured in very arduous conditions and requiring much care before they could be presented in a form available for reference.

The State of the Ice in the Arctic Seas, 1903. *Special print of the Nautical Meteorological Annual of the Danish Meteorological Institute.* Copenhagen, 1904. Size 12½ × 9½. Pp. xxiv. Maps.

THIS prompt and useful publication gives for each month, from April to August, a chart showing the condition of the ice in the whole Arctic Sea, so far as it can be ascertained from the reports of vessels trading to those inhospitable regions. The conclusions drawn from a careful study of all the available data are that the temperate seas have been invaded by about the normal quantity of drifting ice during 1903, but that the Labrador current flowing down past the Banks of Newfoundland carried with it an unusual number of icebergs, many of them being of exceptional size. In fact, on the routes of the trans-Atlantic steamers there has not been so much ice to be seen for many years. This condition of things had been foreseen and predicted a year ago on account of the small number of bergs liberated in 1902; but there is no indication to be drawn from last year as to the probable condition of the ocean routes in 1904.

METEOROLOGICAL NEWS AND NOTES.

THE INTERNATIONAL COUNCIL FOR THE STUDY OF THE SEA met for the third time from February 22nd to 27th at Hamburg, when the physical and meteorological aspects of the work were represented by the following delegates and experts:—Belgium, Professor Gilson of Louvain; Denmark, Mr. Martin Knudsen of Copenhagen; Finland, Professor Homén of Helsingfors; Germany, Professor Krümmel of Kiel; Great Britain, Dr. H. R. Mill of London; Holland, Dr. Wind of the Royal Meteorological Institute de Bilt; Norway, Professor Fridtjof Nansen of Christiana; Russia, Professor Knipovich of St. Petersburg; Sweden, Professor Pettersson of Stockholm. New forms of apparatus for measuring the direction and velocity of currents at various depths in the sea were exhibited by Professors Nansen and Pettersson, the latter also showing improved deep-sea thermometers. The Council recommended that current measurements be made a part of the routine of the seasonal cruises of the various countries, and also that an effort be made to extend the admirable system of observations of surface temperature made on board the steamers of the Dutch lines to all parts of the North Sea. The Senates of Hamburg and of Bremen, and the Directors of the Hamburg-American line, entertained the International Council in *princely style during* the meeting.

DAILY KITE ASCENTS now form part of the routine of the meteorological work at the Deutsche Seewarte in Hamburg as well as at the Aeronautical Institute in Berlin. The temperatures, humidities, and wind velocities observed at various heights, up to 7,000 or 8,000 feet in favourable conditions, are published daily in the weather reports. The number of kites used depends on the strength of the wind, and there are comparatively few days when an ascent of some kind is impossible. The German meteorological authorities make a special point of recording the observations from high-level observatories, and they hope at an early date to supplement the continental records with those from Ben Nevis.

MR. W. C. NASH has, we learn from *The Observatory*, retired, in accordance with the rules of the Admiralty Service, from the post of Superintendent of the Magnetical and Meteorological Department at Greenwich Observatory. Mr. Nash was attached to this department when he joined the staff of the Observatory in 1856, and assisted Mr. Glaisher in much of his work, including some of the balloon ascents. He succeeded Mr. William Ellis as Superintendent of the Department in 1894.

LE TEMPS QU'IL FAIT—which may be Englished as *The Weather we have*—is the title of a new monthly magazine designed for the popularization of meteorology, and published at Mons in Belgium. The first three numbers have already appeared, and the cover at once attracts attention by its artistic if somewhat wintry appearance. The contents are designed for the non-scientific person interested in observing the weather.

THE PATH OF THE AIR IN CYCLONES is investigated in a recent number of the *Meteorologische Zeitschrift* by Dr. W. Meinardus, who proves by mathematical reasoning that the trajectories of particles of air in an unsymmetrical moving cyclone correspond very closely with the actual trajectories found by Dr. W. N. Shaw to be followed by the air in particular cases. Dr. Meinardus mentions that Dr. Assmann has devised a method by which a balloon may be caused to float in any desired stratum of air and trace out its path on the surface of the ground by dropping some easily recognisable material continuously for a considerable time.

RAINFALL AND TEMPERATURE, FEBRUARY, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches.	inches.	in.								
I.	London (Camden Square) ...	2·58	+ 1·11	·48	9	19	54·3	20	27·9	29	8	24
II.	Tenterden ...	2·94	+ 1·24	·63	9	21	51·0	20, 21	25·5	29	12	21
,,	Hartley Wintney ...	3·43	+ 1·80	·57	12	23	54·0	20*a*	27·0	27*b*	15	19
III.	Hitchin ...	2·86	+ 1·40	·55	9	17	53·0	21	25·0	28	17	...
,,	Winslow (Addington) ...	3·18	+ 1·72	·78	9	17	53·0	21	24·0	29	14	23
IV.	Bury St. Edmunds (Westley)	2·81	+ 1·27	·50	9	18	54·5	21	25·0	28	...	...
,,	Brundall ...	3·17	+ 1·65	·38	17	24	55·0	21	26·2	28	9	18
V.	Alderbury ...	4·10	+ 2·02	·67	12	24	47·0	20	23·0	28, 29	16	...
,,	Winterborne Steepleton ...	6·49	...	·96	2	22	49·7	20	21·4	29	10	15
,,	Torquay (Cary Green) ...	5·93	...	·89	12	22	53·9	22	32·3	19	0	14
,,	Polapit Tamar [Launceston]	7·59	+ 4·98	1·14	14	24	51·1	21	23·2	29	11	12
VI.	Stroud (Upfield) ...	4·40	+ 2·48	·73	9	22	49·0	20	26·0	28	14	...
,,	Church Stretton (Woolstaston)	4·08	+ 2·08	·42	9	23	50·5	20, 21	20 0	29	20	...
,,	Bromsgrove (Stoke Reformatory)	2·86	+ 1·44	·37	9	20	48·0	20, 21	21·0	28	17	...
VII.	Boston ...	2·31	+ ·96	·42	17	14	50·0	20	27·0	27	...	...
,,	Bawtry (Hesley Hall) ...	2·92	+ 1·47	1·21	3	20	50·0	19, 20	24·0	29	17	...
,,	Derby (Midland Railway)...	2·80	+ 1·35	·65	3	20	54·0	20	24·0	28	17	...
VIII.	Bolton (The Park) ...	3·82	+ 1·38	·54	3	20	50·2	21	23·2	29	10	22
IX.	Wetherby (Ribston Hall) ...	3·34	+ 1·90	·53	3	22	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	5·18	+ ·36	·88	12	23	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	2·18	+ ·46	·58	3	23	54·0	21	29·0	29	12	26
X.	Newcastle (Town Moor) ...	2·60	+ 1·18	·33	3	19	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	10·13	+ 1·64	2·44	13	16	...	...	...	...	...	...
XI.	Cardiff (Ely) ...	6·21	+ 3·32	·76	9	22	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	6·10	+ 2·76	·94	25	21	50·8	12, 20	28·0	29	5	18
,,	Aberystwith (Gogerddan)..	4·59	+ 1·44	·60	19	17	51·0	21, 23	20·0	29	17	...
,,	Llandudno ...	3·00	+ 1·05	·60	3	22	53·0	21	25·5	29	2	...
XII.	Cargen [Dumfries] ...	2·89	— ·77	·76	12	15	49·0	22	21·0	19, 29	12	...
XIII.	Edinburgh (Royal Observy.)	2·38	...	·40	5	20	48·4	21	22·1	29	12	22
XIV.	Colmonell ...	3·80	+ ·39	·90	19, 25	...	50·0	19	24·0	1	10	...
XV.	Tighnabruaich ...	5·44	...	1·14	24	15	46·0	20	26·0	14*c*	16	18
,,	Mull (Quinish) ...	5·47	+ 1·08	·83	25	20	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	2·92	+ ·14	·44	3	15	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	4·25	+ 2·12	·95	6	20	46·9	20	25·0	29	17	...
XVII.	Braemar ...	1·44	— 1·14	·34	12	19	42·2	27	10·8	11	24	29
,,	Aberdeen (Cranford) ...	4·07	+ 1·66	·65	12	21	47·0	12, 13	25 0	16, 18	16	...
,,	Cawdor (Budgate) ...	2·29	+ ·35	·40	13	19	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	4·34	— 2·98	1·39	19	22	46·1	28	20·2	19	19	...
,,	Bendamph. ...	3·76	— 2·88	1·00	19	16	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	3·78	+ 1·36	·87	21	16	49·5	27	24·0	19	18	...
,,	Castletown ...	4·40	...	·44	21	25	42·0	19	23·0	16, 17	22	...
XX.	Killarney ...	5·72	+ 1·51	·59	18	26	58·0	12	29·0	1	...	...
,,	Waterford (Brook Lodge)...	6·39	+ 3·48	·77	29	25	53·0	20	25·0	1	9	...
,,	Broadford (Hurdlestown) ...	4·89	+ 2·67	·75	28	25	49·0	20	28·0	...	15	...
XXI.	Carlow (Browne's Hill) ...	3·75	+ 1·20	·52	12	24	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	3·31	+ 1·36	·46	12	17	56·5	21	30·0	17	5	16
XXII.	Ballinasloe ...	5·17	+ 2·74	·56	29	28	67·0	19, 20	20·0	1	23	...
,,	Clifden (Kylemore House)..	8·04	+ 2·13	1·41	28	24	...	...	...	...	...	...
XXIII.	Seaforde ...	4·34	+ 1·55	·68	12	22	51·0	21	24·0	9	15	17
,,	Londonderry (Creggan Res.)	2·78	+ ·07	·39	25	18	...	...	...	...	...	...
,,	*Omagh (Edenfel)* ...	5·40	+ 2·80	·95	12	21	50·0	19, 21	24·0	10, 16	16	20
	Bandamph (January) ...	12·58	+ 2·98	1·98	10	22	...	...	...	...	...	...

shows that the fall was above the average; — that it was below it. a and 21, 22. b and 28 29. c and 18, 29.

SUPPLEMENTARY RAINFALL, FEBRUARY, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	3·92	XI.	New Radnor, Ednol	6·01
,,	Sheppey, Leysdown	2·33	,,	Rhayader, Nantgwillt	7·38
,,	Hailsham	3·56	,,	Lake Vyrnwy	6·77
,,	Crowborough	3·96	,,	Ruthin, Plâs Drâw	4·18
,,	Ryde, Beldornie Tower	3·23	,,	Criccieth, Talarvor	3·25
,,	Emsworth, Redlands	3·60	,,	Anglesey, Lligwy	3·24
,,	Alton, Ashdell	4·36	,,	Douglas, Woodville	4·74
,,	Newbury, Welford Park	3·72	XII.	Stoneykirk, Ardwell House	3·84
III.	Harrow Weald	2·58	,,	Dalry, Old Garroch	5·32
,,	Oxford, Magdalen College	2·84	,,	Langholm, Drove Road	4·09
,,	Banbury, Bloxham	4·54	,,	Moniaive, Maxwelton House	4·20
,,	Pitsford, Sedgebrook	3·41	,,	Lilliesleaf, Riddell	2·97
,,	Huntingdon, Brampton	2·91	XIII.	N. Esk Reservoir [Penicuick]	3·85
,,	Wisbech, Bank House	2·28	XIV.	Maybole, Knockdon Farm	2·90
IV.	Southend	1·90	,,	Glasgow, Queen's Park	2·23
,,	Colchester, Lexden	2·16	XV.	Inveraray, Newtown	6·28
,,	Saffron Waldon, Newport	3·25	,,	Ballachulish, Ardsheal	7·64
,,	Rendlesham Hall	2·18	,,	Campbeltown, Redknowe	3·64
,,	Swaffham	3·15	,,	Islay, Eallabus	4·07
,,	Blakeney	3·02	XVI.	Dollar	3·79
V.	Bishop's Cannings	3·13	,,	Balquhidder, Stronvar	6·32
,,	Ashburton, Druid House	9·51	,,	Coupar Angus Station	3·70
,,	Okehampton, Oaklands	7·84	,,	Blair Atholl	2·58
,,	Hartland Abbey	5·22	,,	Montrose, Sunnyside	3·18
,,	Lynmouth, Rock House	5·86	XVII.	Alford, Lynturk Manse	4·21
,,	Probus, Lamellyn	7·20	,,	Keith, H.R.S.	3·35
,,	Wellington, The Avenue	5·50	XVIII.	Fearn, Lower Pitkerrie	2·21
,,	North Cadbury Rectory	4·21	,,	S. Uist, Askernish	3·81
VI.	Clifton, Pembroke Road	4·09	,,	Invergarry	4·39
,,	Moreton-in-Marsh, Longboro'	5·03	,,	Aviemore, Alvie Manse	1·34
,,	Ross, The Graig	4·42	,,	Loch Ness, Drumnadrochit	2·16
,,	Shifnal, Hatton Grange	3·50	XIX.	Invershin	3·86
,,	Wem Rectory	3·13	,,	Altnaharra	3·06
,,	Cheadle, The Heath House	3·11	,,	Bettyhill	2·53
,,	Coventry, Kingswood	3·42	,,	Watten, H.R.S.	3·01
VII.	Market Overton	3·51	XX.	Cork, Wellesley Terrace	5·78
,,	Market Rasen	2·55	,,	Darrynane Abbey	7·51
,,	Worksop, Hodsock Priory	3·23	,,	Glenam [Clonmell]	5·81
VIII.	Neston, Hinderton	3·28	,,	Ballingarry, Hazelfort	4·10
,,	Southport, Hesketh Park	3·81	,,	Miltown Malbay	6·09
,,	Chatburn, Middlewood	4·14	XXI.	Gorey, Courtown House	4·28
,,	Duddon Valley, Seathwaite Vic.	6·75	,,	Moynalty, Westland	4·25
IX.	Langsett Moor, Up. Midhope	6·27	,,	Athlone, Twyford	5·49
,,	Baldersby	2·46	,,	Mullingar, Belvedere	5·24
,,	Scalby, Silverdale	3·01	XXII.	Woodlawn	5·60
,,	Ingleby Greenhow Vicarage	3·06	,,	Westport, Murrisk Abbey	7·25
,,	Middleton, Mickleton	1·80	,,	Crossmolina, Enniscoe	7·53
X.	Beltingham	2·21	,,	Collooney, Markree Obsy	4·47
,,	Bamburgh	2·55	XXIII.	Enniskillen, Portora	5·21
,,	Keswick, The Bank	5·13	,,	Warrenpoint	3·23
,,	Melmerby Rectory	2·95	,,	Banbridge, Milltown	2·92
XI.	Llanfrechfa Grange	6·68	,,	Belfast, Springfield	4·10
,,	Treherbert, Tyn-y-waun	10·00	,,	Bushmills, Dundarave	2·52
,,	Llandovery, Tonn	4·57	,,	Stewartstown	3·80
,,	Castle Malgwyn	5·23	,,	Killybegs	5·33
,,	Llandefaelog-fach	5·47	,,	Horn Head	3·51

Ryde, Beldornie Tower (January) .... 2·97.

RAINFALL AND TEMPERATURE, FEBRUARY, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	2·58	+ 1·11	·48	9	19	54·3	20	27·9	29	8	24
II.	Tenterden ...	2·94	+ 1·24	·63	9	21	51·0	20, 21	25·5	29	12	21
,,	Hartley Wintney ...	3·43	+ 1·80	·57	12	23	54·0	20*a*	27·0	27*b*	15	19
III.	Hitchin ...	2·86	+ 1·40	·55	9	17	53·0	21	25·0	28	17	...
,,	Winslow (Addington) ...	3·18	+ 1·72	·78	9	17	53·0	21	24·0	29	14	23
IV.	Bury St. Edmunds (Westley)	2·81	+ 1·27	·50	9	18	54·5	21	25·0	28	..	...
,,	Brundall ...	3·17	+ 1·65	·38	17	24	55·0	21	26·2	28	9	18
V.	Alderbury ...	4·10	+ 2·02	·67	12	24	47·0	20	23·0	28, 29	16	...
,,	Winterborne Steepleton ...	6·49	...	·96	2	22	49·7	20	21·4	29	10	15
,,	Torquay (Cary Green) ...	5·93	...	·89	12	22	53·9	22	32·3	19	0	14
,,	Polapit Tamar [Launceston]	7·59	+ 4·98	1·14	14	24	51·1	21	23·2	29	11	12
VI.	Stroud (Upfield) ...	4·40	+ 2·48	·73	9	22	49·0	20	26·0	28	14	...
,,	Church Stretton (Woolstaston)	4·08	+ 2·08	·42	9	23	50·5	20, 21	20 0	29	20	...
,,	Bromsgrove (Stoke Reformatory)	2·86	+ 1·44	·37	9	20	48·0	20, 21	21·0	28	17	...
VII.	Boston ...	2·31	+ ·96	·42	17	14	50·0	20	27·0	27	...	...
,,	Bawtry (Hesley Hall) ...	2·92	+ 1·47	1·21	3	20	50·0	19, 20	24·0	29	17	...
,,	Derby (Midland Railway)...	2·80	+ 1·35	·65	3	20	54·0	20	24·0	28	17	...
VIII.	Bolton (The Park) ...	3·82	+ 1·38	·54	3	20	50·2	21	23·2	29	10	22
IX.	Wetherby (Ribston Hall) ...	3·34	+ 1·90	·53	3	22	...	...	...	...	..	...
,,	Arncliffe Vicarage ...	5·18	+ ·36	·88	12	23	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	2·18	+ ·46	·58	3	23	54·0	21	29·0	29	12	26
X.	Newcastle (Town Moor) ...	2·60	+ 1·15	·33	3	19	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	10·13	+ 1·64	2·44	13	16	...	...	...	...	...	...
XI.	Cardiff (Ely) ...	6·21	+ 3·32	·76	9	22	...	...	...	...	...	..
,,	Haverfordwest (High St)..	6·10	+ 2·76	·94	25	21	50·8	12, 20	28·0	29	5	18
,,	Aberystwith (Gogerddan)..	4·59	+ 1·44	·60	19	17	51·0	21, 23	20·0	29	17	...
,,	Llandudno ...	3·00	+ 1·05	·60	3	22	53·0	21	25·5	29	2	...
XII.	Cargen [Dumfries] ...	2·89	— ·77	·76	12	15	49·0	22	21·0	19, 29	12	...
XIII.	Edinburgh (Royal Observy.)	2·38	...	·40	5	20	48·4	21	22·1	29	12	22
XIV.	Colmonell ...	3·80	+ ·39	·90	19, 25	...	50·0	19	24·0	1	10	...
XV.	Tighnabruaich ...	5·44	...	1·14	24	15	46·0	20	26·0	14*c*	16	18
,,	Mull (Quinish) ...	5·47	+ 1·08	·83	25	20	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	2·92	+ ·14	·44	3	15	...	...	...	...	..	...
,,	Dundee (Eastern Necropolis)	4·25	+ 2·12	·95	6	20	46·9	20	25·0	29	17	...
XVII.	Braemar ...	1·44	— 1·14	·34	12	19	42·2	27	10·8	11	24	29
,,	Aberdeen (Cranford) ...	4·07	+ 1·66	·65	12	21	47·0	12, 13	25 0	16, 18	16	...
,,	Cawdor (Budgate) ...	2·29	+ ·35	·40	13	19	...	...	...	...	..	...
XVIII.	Glencarron Lodge ...	4·34	— 2·98	1·39	19	22	46·1	28	20·2	19	19	...
,,	Bendamph. ...	3·76	— 2·88	1·00	19	16	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	3·78	+ 1·36	·87	21	16	49·5	27	24·0	19	18	...
,,	Castletown ...	4·40	...	·44	21	25	42·0	19	23·0	16, 17	22	...
XX.	Killarney ...	5·72	+ 1·51	·59	18	26	58·0	12	29·0	1	...	...
,,	Waterford (Brook Lodge)...	6·39	+ 3·48	·77	29	25	53·0	20	25·0	1	9	...
,,	Broadford (Hurdlestown) ...	4·89	+ 2·67	·75	28	25	49·0	20	28·0	...	15	...
XXI.	Carlow (Browne's Hill) ...	3·75	+ 1·20	·52	12	24	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	3·31	+ 1·36	·46	12	17	56·5	21	30·0	17	5	16
XXII.	Ballinasloe ...	5·17	+ 2·74	·56	29	28	67·0	19, 20	20·0	1	23	...
,,	Clifden (Kylemore House)..	8·04	+ 2·13	1·41	28	24	...	...	...	...	...	...
XXIII.	Seaforde ...	4·34	+ 1·55	·68	12	22	51·0	21	24·0	9	15	17
,,	Londonderry (Creggan Res.)	2·78	+ ·07	·39	25	18	...	...	...	...	...	...
,,	*Omagh (Edenfel)* ...	5·40	+ 2·80	·95	12	21	50·0	19, 21	24·0	10, 16	16	20
	Bandamph (January) ...	12·58	+ 2·98	1·98	10	22	...	...	...	...	...	...

hows that the fall was above the average; — that it was below it. *a* and 21, 22. *b* and 28 29. *c* and 18, 29.

SUPPLEMENTARY RAINFALL, FEBRUARY, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	3·92	XI.	New Radnor, Ednol	6·01
,,	Sheppey, Leysdown	2·33	,,	Rhayader, Nantgwillt	7·38
,,	Hailsham	3·56	,,	Lake Vyrnwy	6·77
,,	Crowborough	3·96	,,	Ruthin, Plâs Drâw	4·18
,,	Ryde, Beldornie Tower	3·23	,,	Criccieth, Talarvor	3·25
,,	Emsworth, Redlands	3·60	,,	Anglesey, Lligwy	3·24
,,	Alton, Ashdell	4·36	,,	Douglas, Woodville	4·74
,,	Newbury, Welford Park	3·72	XII.	Stoneykirk, Ardwell House	3·84
III.	Harrow Weald	2·58	,,	Dalry, Old Garroch	5·32
,,	Oxford, Magdalen College	2·84	,,	Langholm, Drove Road	4·09
,,	Banbury, Bloxham	4·54	,,	Moniaive, Maxwelton House	4·20
,,	Pitsford, Sedgebrook	3·41	,,	Lilliesleaf, Riddell	2·97
,,	Huntingdon, Brampton	2·91	XIII.	N. Esk Reservoir [Penicuick]	3·85
,,	Wisbech, Bank House	2·28	XIV.	Maybole, Knockdon Farm	2·90
IV.	Southend	1·90	,,	Glasgow, Queen's Park	2·23
,,	Colchester, Lexden	2·16	XV.	Inveraray, Newtown	6·28
,,	Saffron Waldon, Newport	3·25	,,	Ballachulish, Ardsheal	7·64
,,	Rendlesham Hall	2·18	,,	Campbeltown, Redknowe	3·64
,,	Swaffham	3·15	,,	Islay, Eallabus	4·07
,,	Blakeney	3·02	XVI.	Dollar	3·79
V.	Bishop's Cannings	3·13	,,	Balquhidder, Stronvar	6·32
,,	Ashburton, Druid House	9·51	,,	Coupar Angus Station	3·70
,,	Okehampton, Oaklands	7·84	,,	Blair Atholl	2·58
,,	Hartland Abbey	5·22	,,	Montrose, Sunnyside	3·18
,,	Lynmouth, Rock House	5·86	XVII.	Alford, Lynturk Manse	4·21
,,	Probus, Lamellyn	7·20	,,	Keith, H.R.S.	3·35
,,	Wellington, The Avenue	5·50	XVIII.	Fearn, Lower Pitkerrie	2·21
,,	North Cadbury Rectory	4·21	,,	S. Uist, Askernish	3·81
VI.	Clifton, Pembroke Road	4·09	,,	Invergarry	4·39
,,	Moreton-in-Marsh, Longboro'	5·03	,,	Aviemore, Alvie Manse	1·34
,,	Ross, The Graig	4·42	,,	Loch Ness, Drumnadrochit.	2·16
,,	Shifnal, Hatton Grange	3·50	XIX.	Invershin	3·86
,,	Wem Rectory	3·13	,,	Altnaharra	3·06
,,	Cheadle, The Heath House.	3·11	,,	Bettyhill	2·53
,,	Coventry, Kingswood	3·42	,,	Watten, H.R.S.	3·01
VII.	Market Overton	3·51	XX.	Cork, Wellesley Terrace	5·78
,,	Market Rasen	2·55	,,	Darrynane Abbey	7·51
,,	Worksop, Hodsock Priory	3·23	,,	Glenam [Clonmell]	5·81
VIII.	Neston, Hinderton	3·28	,,	Ballingarry, Hazelfort	4·10
,,	Southport, Hesketh Park	3·81	,,	Miltown Malbay	6·09
,,	Chatburn, Middlewood	4·14	XXI.	Gorey, Courtown House	4·28
,,	Duddon Valley, Seathwaite Vic.	6·75	,,	Moynalty, Westland	4·25
IX.	Langsett Moor, Up. Midhope	6·27	,,	Athlone, Twyford	5·49
,,	Baldersby	2·46	,,	Mullingar, Belvedere	5·24
,,	Scalby, Silverdale	3·01	XXII.	Woodlawn	5·60
,,	Ingleby Greenhow Vicarage	3·06	,,	Westport, Murrisk Abbey	7·25
,,	Middleton, Mickleton	1·80	,,	Crossmolina, Enniscoe	7·53
X.	Beltingham	2·21	,,	Collooney, Markree Obsy	4·47
,,	Bamburgh	2·55	XXIII.	Enniskillen, Portora	5·21
,,	Keswick, The Bank	5·13	,,	Warrenpoint	3·23
,,	Melmerby Rectory	2·95	,,	Banbridge, Milltown	2·92
XI.	Llanfrechfa Grange	6·68	,,	Belfast, Springfield	4·10
,,	Treherbert, Tyn-y-waun	10·00	,,	Bushmills, Dundarave	2·52
,,	Llandovery, Tonn	4·57	,,	Stewartstown	3·80
,,	Castle Malgwyn	5·23	,,	Killybegs	5·38
,,	Llandefaelog-fach	5·47	,,	Horn Head	3·51

Ryde, Beldornie Tower (January) .... 2·97.

METEOROLOGICAL NOTES ON FEBRUARY, 1904.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

London, Camden Square.—Ungenial and lacking in sunshine, with frequent R and uniform temp. Slight frost during the last week with light S showers. Duration of sunshine 41·5 hours, and of R 57·1 hours. Mean temp. 39°·4, or 0°·4 below the average.

Tenterden.—Again wet, with much wind in the middle. The last week was drier with E. wind, but S at the close. Duration of sunshine 75 hours. Very low bar. from 8th to 11th, reading 28·68 in. on 9th.

Sheppey, Leysdown.—Mild and unsettled until 23rd, then cold N.E. wind with frost, and about 6 inches of S from 27th to 29th. Terrific gale on 12th and strong gales on 8th, 9th and 21st. TS on 13th.

Crowborough.—The first three weeks were mild with R almost continuously, and the last week very cold with frost and S. H on 3 days, S on 6 days. Prevailing winds W. and S. till 22nd, then N. and E. Mean temp. 37°·4.

Hartley Wintney.—The cloud and gloom of the preceeding month continued until the end of the third week, with R daily. The last week was brighter with more sun, cold E. wind and slight S showers. Ozone on 17 days with a mean of 4·0.

Winslow, Addington.—Except 1883 and 1900 the wettest February in 34 years. The last week was very cold, with a slight sprinkling of S.

Pitsford, Sedgebrook.—Another wet, cold and gloomy month with constant slight S. R 1·42 in. above the average of 10 years. Mean temp. 36°·6.

Colchester, Lexden.—Stormy till 14th, with R every day but one. Then colder and much drier with E. wind from 24th and traces of S.

Bury St. Edmunds.—Only 3 days without R till 17th, with southerly winds. E. winds set in on 22nd with frosts and dry weather.

Brundall.—Mean temp. 38°·9, or 0°·7 above the average of 20 years, but 5°·4 below that of February, 1903. Very damp and rainy for the first three weeks. Winterly at the close with S.

Winterborne Steepleton.—R more than double the average of 11 years.

Torquay, Cary Green.—R 3·24 in. above the average. Mean temp. 42°·7, or 0°·4 below the average. Duration of sunshine 62·7 hours, or 18·9 hours below the average. Mean amount of ozone 5·9. Max. 9·0 on 13th with W. wind; min. 1·0 on 28th with E.N.E. wind.

Ashburton, Druid House.—Excessive R, the total being 4·84 in. above the average of 38 years. This fall was exceeded in 1883, 10·10 in., and 1900, 11·07 in. The lowest falls in February were ·00 in. in 1895 and ·03 in. in 1891.

Lynmouth, Rock House.—Colder than January with very heavy H storms.

Wellington.—Abnormally wet, R falling every day, and at times very heavily. The total fall was almost double the average.

North Cadbury.—Temp. about normal in all points, but the last week a good deal the coldest. The air was reeking with moisture till the last week when drying E. airs began.

Clifton, Pembroke Road.—Very wet, with R 1·60 in. above the average and frequent gales from S.W. Sharp frost on 28th and 29th and S or sleet on four days. T and L on the night of 12th.

Ross, The Graig.—Very wet till 17th, and very unpleasant weather most of the month. The meadows were saturated from the excess of R, but the Wye was not much flooded. Temp. near the average.

Bolton.—Dull, changeable and humid, with low temp., particularly during the last 3 days. Mean temp. 36°·6, or 0°·8 below the average. Duration of sunshine 16·8 hours on 9 days, being 21·6 hours less than the average, and the lowest February record. S on 6 days, 2 inches falling on 15th and 5 inches on 25th.

Southport.—Exceptionally wet and cloudy, the mean pressure being

exceedingly low. Meam temp. 0°·9 below the average. Duration of sunshine 28 hours below the average. The underground water level was remarkably high. Total depth of S 4·3 in. R 1·81 in. above the average.

SEATHWAITE VICARAGE.—Generally mild and rainy till the closing week, which was marked by the heaviest S and sharpest frost of the season.

HULL, PEARSON PARK.—Very dull, with R and frequently cold. Extremely cloudy throughout. S on 18th.

LLANFRECHFA GRANGE.—Mild till 15th, then frost at night. R rather unusually heavy, but in 1900 there was 9·31 in., and in 1893 6·44 in.

LLANDOVERY.—Cold, wet and changeable for the most part, with mean temp. 39°·0. Violent storms with T from 12th to 14th, after which S, R and frost to 20th. Mild and wet to 25th, afterwards fairly dry and cold.

HAVERFORDWEST.—Remarkable for low max. temp., reaching 50° on 3 days only. Very wet from 8th to 10th, with bar. below 29 in. From 12th to 14th stormy and cold. Duration of sunshine 28·9 hours.

ABERYSTWITH.—Very cold and wet till the last few days, which were fine, with cold N.E. winds. Unseasonable throughout.

DOUGLAS.—Very wet, sunless and depressing. R fell on every day till 27th. Frost on 1st and on last two days. Temp. about the average. H on 11th; S on 3 days. Spring flowers were ruined by wet.

SCOTLAND.

CARGEN [DUMFRIES].—Sunless though dry. Vegetation was severely checked by cold E. wind in the last week.

MAXWELTON HOUSE.—Cold, wet and snowy, with a few very fine days. Mean temp. 35°, or 5° below the average. R 1·10 in. above the average. Seven inches of S on 17th.

MULL, QUINISH.—Cold, wet and unsettled, with constant sudden changes.

COUPAR ANGUS.—Exceedingly wet and very mild. Persistent R during the first half, but no floods. Mean temp. 43°·2, the highest for 25 years.

ALTNAHARRA.—Very fine and open, and upon the whole exceptionally mild.

BETTYHILL.—The R was light except for a day or two, and the weather generally frosty with a few bright warm days.

WATTEN.—Wet and squally and very changeable, with slight frosts and frequent storms of R, sleet and S.

CASTLETOWN.—The first part was very damp, with E. and S.E. winds and daily R or S.

IRELAND.

CORK.—R 2·34 in. over the average, and mean temp. 5°·0 below the average. The city floods of 1st and 2nd were due to the diminished pressure over the ocean, S.E. wind blowing into the harbour, and the river swollen from the recent R. On 14th ·60 in. of R fell in 9 hours.

DARRYNANE ABBEY.—The wettest February in 25 years, the fall being 76 per cent. above the average. The fall for January and February was 46 per cent. above the average.

MILTOWN MALBAY.—Very cold, stormy and wet, preventing all attempts at tillage, and winding up with a storm of S, sleet and R, which flooded the entire country. Much H; T, L, and stormy weather prevailed.

DUBLIN, FITZWILLIAM SQUARE.—Dull, cold, damp and rainy. Mean temp. 40°·7. The bar. was persistently low in the week ending 13th, the mean for the seven days being only 29·035 in. Sharp TS on the evening of 12th.

COLLOONEY, MARKREE OBSERVATORY.—Frequent S storms. T and L on one day. Gales on four days. Duration of sunshine 41·4 hours.

BELFAST, SPRINGFIELD.—Rather an unpleasant month. The frost was not sufficient to benefit the land. The wettest February since 1894.

OMAGH, EDENFEL.—Raw, wet and unsettled almost without intermission, with R above and temp. below the average, and frequent strong winds, approaching but not reaching the violence of gales.

Climatological Table for the British Empire, September, 1903.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	83·7	2	38·1	17	67·6	50·8	52·0	83	121·8	35·1	2·64	13	5·3
Malta	100·3	13	55·4	29	82·1	68·4	64·4	71	148·7	53·5	1·09	3	3·6
Lagos, W. Africa	85·0	21*a*	68·0	28	82·9	73·9	73·1	79	145·0	68·0	9·92	15	...
Cape Town	87·2	4	40·6	15	66·8	51·2	51·8	77	...	...	2·29	13	5·2
Durban, Natal	96·1	29	48·9	2	75·9	57·2	...	...	144·3	...	·62	7	3·7
Mauritius	80·5	19	55·4	9	76·5	62·0	58·2	70	143·7	45·3	1·66	20	5·8
Calcutta	91·9	21	72·8	12	87·8	77·8	77·2	86	138·4	71·9	14·02	12	8·2
Bombay	88·1	16	73·3	19	85·4	77·2	76·2	84	138·8	71·7	7·82	24	7·2
Madras	96·3	7	71·6	20	90·3	76·2	75·7	84	147·1	70·8	8·21	15	5·5
Kodaikanal	66·0	27	50·8	11	62·2	52·9	53·1	89	143·6	46·1	9·73	20	8·3
Colombo, Ceylon	89·2	20	72·5	22	87·2	77·1	74·7	84	149·0	72·0	8·06	21	8·1
Hongkong	87·7	19	73·0	6	82·9	75·8	73·1	84	134·8	...	16·54	15	6·2
Melbourne	80·2	11	34·4	15	62·7	47·5	43·3	70	141·7	28·2	3·18	11	6·6
Adelaide	81·2	11	40·1	30	66·2	48·5	45·2	65	135·3	33·7	2·85	16	5·0
Coolgardie	87·8	26	37·9	7	68·9	45·7	44·4	62	149·4	33·9	·61	12	4·6
Sydney	65·0	12	44·4	21	67·0	53·0	47·9	69	117·0	38·0	4·33	15	5·0
Wellington	63·5	12	33·0	6	56·1	42·8	39·9	64	111·0	22·0	4·36	17	6·5
Auckland	64·5	21	42·0	6	59·6	49·2	45·1	71	134·0	39·0	2·40	16	5·2
Jamaica, Negril Point	91·0	27	70·2	12	87·5	73·6	73·9	80	...	...	6·26	9	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	90·0	21	72·0	2	85·4	75·1	71·6	75	154·0	...	9·51	19	2·9
Toronto	83·8	13	33·8	29	71·3	50·6	54·5	78	...	...	·41	7	4·3
Fredericton	81·2	17	32·0	30	69·1	46·5	46·2	60	...	...	2·34	9	4·0
Winnipeg	77·6	18	24·0	15	60·9	38·3	...	...	...	...	2·77	8	5·6
Victoria, B.C.	70·7	4	42·4	30	61·5	49·6	...	...	...	...	3·76	14	6·3
Dawson	65·0	3	19·5	30	51·6	33·3	...	...	...	...	2·41	6	4·0

a and 22, 30.

MALTA.—Mean temp. of air 0°·6 below, dew point 1°·5, and R ·11 in. below averages. Mean hourly velocity of wind 4·0 miles above average. Mean temp. of sea 77°·8. L on 7 days.

Mauritius.—Mean temp. of air 1°·0, and dew point 1°·6 below, and R ·27 in. above, averages. Mean hourly velocity of wind 12·3 miles, or 0·8 above average; extremes, 30·5 on 20th and 2·1 on 7th; prevailing direction E.S.E.

MADRAS.—Rainfall 50 per cent. above average. Bright sunshine 131·5 hours.

KODAIKANAL.—Mean temp. of air 56°·2. Mean velocity of wind 314 miles per day. Bright sunshine 78 hours.

COLOMBO, CEYLON.—Mean temp. of air 81°·0 or 0°·2 above, of dew point 1°·4 above, and R 3·02 in. above, averages. Mean hourly velocity of wind 9·6 miles, prevailing direction S.W. T88 on 5 days.

HONGKONG.—Mean temp. of air 78°·6, or 1°·8 below, and R 3·90 above, averages. Bright sunshine 165·7 hours, or 34 below average. Mean hourly velocity of wind 13 miles; prevailing direction E.

Adelaide.—Mean temp. of air 0°3 above, and R 1·11 in. above, averages.

Sydney.—Mean temp. of air 1°·1 above, humidity 1·4 below, and R 1·32 in. above, averages.

Auckland.—Mean temp. of air close to the average, and R quite one inch under the average.

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THE RAINFALL OF THE WINTER MONTHS.

The month of March concludes the winter half-year, and, before considering that period as a whole, it is desirable to look at the distribution of rainfall for the month. Over the greater part of England the rainfall of March was close to, or rather under, the average of the last ten years, that is to say considerably under the long-period average. In the east of England there was a slight excess of rainfall, the relatively wettest station reported in our tables being Brundall near Norwich, where, however, the excess amounted only to 20 per cent. The deficiency of rainfall was most marked in North Wales, where at Llandudno it amounted to 32 per cent. of the ten years' average.

In Scotland the rain was generally far below the average for the month, especially in the district bordering the Moray Firth, where the total fall of rain was less than one inch, and the deficiency at Cawdor near Nairn amounted to 72 per cent.; in other words, the rainfall was little more than one quarter the usual amount. Ireland, however, showed a considerable excess of rainfall, except in the extreme north where it was dry. The wettest station was Waterford, where the excess amounted to 43 per cent. of the average fall.

The month, in fact, was a very ordinary March so far as rainfall is concerned; rather wet in Ireland, rather dry in Scotland, and as nearly as possible normal in England.

In the ordinary treatment of rainfall statistics the figures are grouped according to the calendar years, but for many purposes it is more natural and more useful to divide the circle of the year into two parts as near the equinoxes as possible. The six months from October to March include the whole Winter, the late Autumn, and the early Spring, and the rainfall at a series of 51 stations for that period is summarised in the following Table. The first column gives the number of inches of rain above (+) or below (—) the ten years' average of the six months, and the second column shows the ratio which the rainfall of the six months bears to that average expressed as 100. It is interesting to compare the figures for the previous winter half-year as given in the number of this Magazine for April, 1903, p. 41. For the sake of clearness, the comparison has been

thrown into a graphic form in the two little maps here reproduced. The unshaded portion indicates the districts in which the six months, including winter, were drier than the average, the increasingly dark shading distinguishes those districts within which the rainfall

exceeded the average by less than 25 per cent., between 25 and 50 per cent., and by more than 50 per cent.; these may be called the wet, wetter and wettest areas. The chief interest in both cases attaches to Great Britain, the rainfall of Ireland having been similar each time, and showing an excess of from 20 to 26 per cent. During 1902-1903 it will be noticed that the wettest area lay in the centre of Scotland, and the dry area was confined to Caithness and the east of England. This was due entirely to the extraordinarily high rainfall of the first three months of 1903 in Scotland, when it was comparatively dry in England. During 1903-1904, on the other hand, the dry area was confined to northern Scotland, including almost the whole of the Highlands, while the greater part of England had a rainfall more than 25 per cent. in excess of the average, rising in the south in the Thames valley and the land bordering the Bristol Channel to an excess of more than 50 per cent. This was mainly due to the extraordinarily heavy rainfall of October, 1903, in that region.

For the British Isles, as a whole, the two periods of six months had approximately the same total rainfall, 1902-3 having an excess seven per cent. less than 1903-4; but in the latter period England was 30 per cent. wetter than in the former, while both Scotland and Ireland were drier. The exact ratios to the average of 100 are:—

	1902-3.	1903-4.	Diff.
England and Wales	107	137	+ 30
Scotland	127	107	— 20
Ireland.....	126	120	— 6
British Isles	117	123	+ 6

The curious interchange of position in the wettest and the dry area may be summed up by saying that in the winter half-year, 1902-3, the country grew wetter from south-east to north-west, while in the winter half-year, 1903-4, it grew wetter from north to south, the wetness and dryness being considered relatively to the ten-years' average at each point.

Six Months' Winter Rainfall: October, 1903—March, 1904.

Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London .....+	4·43	139	Arncliffe ...+	5·04	114	Braemar ...—	1·61	91
Tenterden .....+	3·79	129	Hull .....+	1·15	109	Aberdeen ...+	3·42	120
Hartl'yW'ntn'y+	7·27	157	Newcastle...+	6·13	148	Cawdor .....—	2·02	86
Hitchin .....+	4·61	140	Seathwaite +	4·73	106	Glencarron —	6·74	88
Winslow .....+	4·68	139	Cardiff .....+	11·30	153	Dunrobin ...—	·19	99
Westley .....+	2·66	122	Haverf'dwest+	7·11	128	Darrynane +	5·17	119
Brundall.....+	2·01	117	Gogerddan +	7·52	130	Waterford +	9·26	146
Alderbury .....+	8·81	158	Llandudno +	3·16	119	Broadford...+	7·59	144
Ashburton .....+	13·91	145	Dumfries ...+	3·17	113	Carlow .....+	2·01	111
Polapit Tamar +	14·95	174	Lilliesleaf ...+	4·40	128	Dublin .....+	·42	103
Stroud .....+	6·57	149	Colmonell ...+	4·71	119	Mullingar...+	3·86	121
Woolstaston ...+	5·88	139	Glasgow ...+	1·49	108	Ballinasloe +	3·53	119
Boston .....+	3·83	140	Inveraray ...+	·17	100	Clifden .. ...+	4·60	111
Hesley Hall ...+	2·87	127	Islay .....+	5·09	119	Crossmolina +	5·32	117
Derby.....+	4·19	139	Mull .....+	6·54	120	Seaforde ...+	4·44	123
Bolton .....+	6·37	132	Loch Leven +	·68	103	Londonderry+	2·49	112
Wetherby .....+	8·10	171	Dundee .....+	1·48	110	Omagh .....+	7·34	136

SOME WEATHER PROPHETS.

By William Ellis, F.R.S.

We are sometimes told that in improving elementary education and teaching the masses to read, the more difficult task of at the same time instilling a desire to read intelligently, has not in equal degree been imparted, a scrappy and sensational class of literature having arisen adapted to the existing order of mind, thus misdirecting an ability that might be better employed. But like all good things, education has also its weak side. In matters scientific the increased opportunities for study in our day are again good, but in this direction also there is misdirected energy. Not that a lesser degree of scientific knowledge is useless, rather is it beneficial when used with discretion, but unfortunately the present facilities for publication are such as to tempt those only partially acquainted with a subject to presume to teach. Their incomplete knowledge instead of suggesting further study and inquiry, seems rather to impel them to publish crude and ill-considered theories that reveal only the incapacity of the

author, who in some blind manner convinces himself that he has all at once discovered that which previous patient workers have failed to find. Ignorance is shown of the conditions of a problem as well as of the proper manner of treating it. There have been those who to their own satisfaction have shown Newton to be wrong, or the Earth to be flat, in spite of overwhelming evidence to the contrary. In our day, however, a favourite pursuit seems to be prediction of the weather and other natural phenomena for long periods in advance. In this field we have many prophets, who seem to consider inductive methods to be to a great extent superfluous, preferring rather to form arbitrary theories of weather change to which Nature is expected to submit; at least, each separate prophet appears to make out that his own particular predictions are verified.

These remarks have been suggested by the variety of publications that we receive treating of weather change and prediction of the weather on a supposed scientific basis that is really grounded in error. We have on our table "The British Astronomical Weather Almanac and Chart, 1904, by B. G. Jenkins, F.R.A.S.," which is said to be "for landed proprietors, farmers, gardeners, sailors, fishermen, and the public generally." This is a large claim to make. Let us examine it a little. The main feature of the almanac is "The British Weather Chart." Investigating the question of weather change, Mr. Jenkins says that although the moon has a great deal to do therewith, her influence alone is not sufficient to account for all the observed weather phenomena, and that the sought-for perturbation is to be found in the combined influence of the sun, moon and planets. The whole matter, however, is said to be fully explained in a separate publication, "'Tellustria'; a method for determining astronomically the variations in the temperature and pressure of the atmosphere." What is called the "telluric curve," showing the disturbance produced in our atmosphere, is given for the whole year, also the corresponding thermometric and barometric curves, with predictions of the probable weather in each month of the year. The explanation given in the almanac is not, however, complete. All this apparently would be satisfactory, but that "there are discrepancies which the telluric curve does not explain, even when it is calculated from estimates of the masses and distances of the planets used by English, French, German, and American astronomers, which are not identical; but it is reasonable to suppose that these will disappear when astronomers have secured more accurate data." It is sad to think that errors in that supposed most exact of all sciences, astronomy, should so hinder the perfecting of a weather theory; but does Mr. Jenkins understand how comparatively insignificant are these so-called discrepancies? Surely, data good enough to foretell eclipses of the sun and moon for very many years to come to within a few seconds of time should be sufficient for his purposes. It is indeed mere trifling; there is no sense of proportion in such a contention. What is proposed cannot be done. Besides, the monthly

forecasts, even if they were in any degree accurate, are altogether so vague. Unfortunately the employment of a scientific phraseology gives an appearance of authority to predictions of the kind that they in no way possess, and the press, which should be able to guide the public mind in the matter, gives not unfrequently only laudatory notices to such works. Mr. Jenkins quotes two on the title-page of his almanac, both from journals of good standing. One of these states that he is "a scientific meteorologist who merits our serious attention," the other says that persons of undoubted veracity declare that it is "wonderfully accurate." But to predict the character of the weather month by month for a year in advance is at present wholly impossible. No editor of any journal of note would be content to show ignorance in matters of art, why then should any editor be satisfied with so low a standard of criticism in a matter involving a little knowledge of science?

To consider now another case. In a volume reviewed in these pages in February, 1903 (Vol. **38**, p. 9), Mr. William Digby, C.I.E., enthusiastically puts forward the theories of Mr. Hugh Clements, of whom we have often heard before. Mr. Clements himself also publishes from time to time pamphlets concerning his far-reaching theories. Here again, as with Mr. Jenkins, the moon is a great agent in producing weather changes, for as the influence of the sun is "exactly the same on any given date of any given month year after year" it may be neglected, "and the moon's motions alone considered in the estimation of weather changes." To predict the weather correctly for any given place it is necessary to know "the actual height of the barometer." This is determined by the consideration that as at the beginning and end of some one of certain lunar cycles (any one of several it seems might be employed) the position of the moon will be nearly similar, the height of the barometer should be also nearly similar, and the reading recorded on the day in the past being corrected for the difference between the two positions of the moon, according to a supposed satisfactorily determined relation, the reading on the day in the future is found. Wonderful, is it not? Unfortunately, however, it has no foundation whatever in fact. Whether Mr. Clements formed his "Weather Predictions for the Autumn, 1904," in this way from heights of the barometer determined as described seems not clear; he, however, gives the dates of unsettled weather for the four months of September to December at some twenty places as widely separated over the globe as London, New York and Tokio. According to this the meteorological condition is to be similar at Christiania, Stockholm and St. Petersburg, and, what is equally remarkable, similar also at Paris and Vienna. By means of the lunar-cycle theory of barometric variation there is to be found in Appendix I. of Mr. Digby's book some wonderful work concerning the height of the barometer on days round that first fixed for the coronation of the King, June 26, 1902, prepared in the previous spring, the energy displayed in which

is, we fear, simply a measure of the uselessness of the result. And as though the absurdities in regard to weather prediction were not enough, Mr. Clements applies his amazing theories to other natural phenonema, claiming to predict earthquakes and volcanic eruptions, both small and great, as accurately as eclipses of the sun and moon. Neither are droughts and famines at all out of his way. It is settled that sun-spots are produced by planetary attraction, and magnetic storms are easily foretold. But these disquisitions on subjects into which we cannot here enter are equally as absurd as are those regarding weather change. The question having been asked in some journal, "When will a Kepler and a Newton arise to evolve order out of chaos in meteorology?" it is contended that in Mr. Clements the man has been found. Indeed, it is seriously suggested that the time is passed when "a proved theory of vast public value, a theory which put into practice . . . . . would make British agriculture less of a chance, and more of a business than it now is, or in existing conditions can ever possibly become, shall be allowed to languish for lack of proper recognition and adequate support," since it is not possible to conceive greater advantages to be derived "from any discovery in recent centuries, or perhaps at any time in the world's history." But yet after working for some twenty years, Mr. Clements finds public bodies to be still indifferent.

Another writer, who expreses himself in agreement with the views of Mr. Clements, sends from Zomba, in British Central Africa, forecasts of rainfall for a year in advance at four separate districts in that region. He endeavours to connect rainfall with lunar action, and writes:—"The above and below years of rain appeared to coincide with more than accidental similarity to the declination of the moon in a 19 years' cycle, and so similar as to suggest that the moon was possibly the cause." The author would appear to be scarcely competent to conduct such inquiries, the knowledge of astronomy disclosed in his communication being of a crude order. He, however, keeps what appears to be a very creditable meteorological register, observations of the usual character being made three times on each day; and this is a solid contribution to scientific knowledge.

Referring to our opening remarks, may we not ask how it happens that men, otherwise of considerable intelligence, can persevere in a task at present so utterly hopeless as the endeavour to predict detailed weather changes for long periods in advance, thus deceiving themselves (if only they knew it) and also those who put any sort of trust therein? When such predictions appear to be in some degree correct, it is entirely a matter of accident, since by no known method, by reference to no celestial body whatever, can the character of the weather, for any length of time in advance, be foretold. One or two such forecasts accidentally fulfilled seem to convince some people that a true weather prophet has at last appeared. They forget all the failures. Even mere guessing will not unfrequently be, to an *extent, right.* Do people ever realize that if the weather were set

down by hazard, in advance, on alternate days throughout some year, as simply "wet" or "dry," how often the "prediction" would be correct? and yet it would all signify *nothing* as regards prevision of the weather.

One idea that so misleads many weather prophets, and also others, is that as the moon is the principal agent in producing ocean tides, so also must she be the main cause of weather change. Such an impression is held more or less strongly by a not inconsiderable number of persons of general intelligence, not exactly perhaps of a scientific turn of mind. Some cannot see, and others have never remarked, what so repeatedly has been pointed out, that tides are a matter of attraction, whilst weather changes are an effect of heat, the action of solar heat on our atmosphere combined with the revolution of the Earth on its axis, by which means are produced all those variations of temperature (daily and yearly), of atmospheric pressure, cloud, wind, and, by evaporation and precipitation also, rainfall, which go to make up what we experience as weather. No sensible heat whatever is received from the moon, and it is doubtful whether any even small degree of lunar influence on weather has ever been definitely traced

The able criticism which Professor Klossovski, of Odessa, has brought to bear on the lunar weather forecasts of his countryman, Mr. Demchinsky, whose wealth and social influence have enabled him to give a more elaborate expression to his views than his fellow-prophets in other lands could attempt, has already been summarised in this Magazine for March, Vol. **39**, p. 31, and the arguments seem absolutely conclusive.

Our own Meteorological Office, receiving daily telegrams of the condition of the weather from numbers of stations covering a wide extent of country including the Continent, can do no more than predict weather for one or two days in advance. We suffer in some degree from the circumstance that our country borders on the Atlantic, from which direction weather changes will so suddenly come, and nothing better in the way of forecasts can be at present done. The use of the Meteorological Office consists as much in the valuable meteorological statistics that are collected, and from time to time published, as in the forming of weather forecasts for the coming day.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

GRADUATION OF RAIN GLASSES.

In the Magazine received this morning I see a letter *re* "Graduation of Rain Glasses." As an observer since 1855, now nearly half a century, I quite agree with the writer that glasses might be more clearly graduated, and that it should be done on both sides. Mine

have always been so, and are clear enough to me now, though I cannot see as well as I used to do. I think they might well be graduated to ·60 in. I have always glued a bit of paper to mine with the graduations above ·50 in. marked on it, but it was seldom required.

MICHAEL FOSTER WARD.

Upton Park, Slough, 17th March, 1904.

YOU ask for the opinion of your readers on the point raised in the last number of the Meteorological Magazine: "the Graduation of Rain Glasses." I see no reason for alteration; rather the reverse. The usual scale engraved on the measuring glasses as supplied, for instance, by Casella fulfils every necessary requirement; with such an instrument I have registered the rainfall for even a longer period than your correspondent. Provided the glass be kept clean, the scale is definite enough; quickness in reading any scale, especially one so simple as usually marked on rain glasses, is to be deprecated.

W. L. W. EYRE.

Swarraton Rectory, Alresford, Hants, March 18th, 1904.

I FOR one quite endorse your correspondent's remarks as to the advisability of more definitely marking the rain measuring glasses, and such a method as he suggests would no doubt lend itself to the accurate reading of them. I do not, however, think it would be at all advisable to alter the length from ·50 in. to ·60 in., for then the reading would be much more liable to error when one is dealing with over an inch of rain, which one has frequently to do in this locality, and I also think that we should find the ·60 in. would just as often be exceeded as ·50 in.; so where would be the gain?

I have just looked through my records for the past four years and find that during that period I have between ·50 and ·60 22 times, and between ·60 and ·70 22 times, exactly the same number.

CHAS. P. CHAMBERS.

Orchard Head, Broughton-in-Furness, April 2nd, 1904.

ABOUT the marking of the measuring glasses of rain gauges: I have been a daily observer and registrar since 1872, and I have never experienced the difficulty which your correspondent mentions. From that time I have used Casella's rain gauge and his glass for measuring, and though my sight may not be as good as the majority of observers possess, I have never had the slightest difficulty. I can always register the exactest decimal point required, and though for uniformity's sake I strictly keep to it, I am often tempted to read more closely still—so easy is it to be even more accurate.

T. W. SIDEBOTHAM.

The Bourne Vicarage, Farnham, 2nd April, 1904.

ATMOSPHERIC PRESSURE IN RELATION TO CLIMATE.

In reply to the letter of Mr. Dines which appeared in the March number, I must say that by "anticyclonic conditions over the British Isles," I do not mean the prevalence (a meaning which, as Mr. Dines says, would be quite incorrect) of a system of high pressure over Scandinavia; in other words, the easterly type of weather, which, as is well known, is often responsible for extremely low temperatures in the south of England.

Of course it is a matter of common observation that many of the anticyclones which temporarily control the weather over the United Kingdom during the winter are not associated with any great reduction of temperature below the mean, and the facts which Mr. Dines adduces doubtless render his assertion, such as it stands, indisputable. But it must be a fact well known to everyone, that after a period of high temperature in winter the effect of the advance of an anticyclone over the United Kingdom is almost invariably to reduce the mean temperature to the normal or slightly below it, and there can be little doubt that if anticyclonic conditions, properly so called, were to set in during the autumn and to persist throughout the winter months, just as they do over the great continental land masses, the mean temperature would sink to somewhere near the normal for a country situated between the 50th and 60th parallels of north latitude—that is to say, it would be from 10° to 20° F. lower than it is—for under these conditions the gradient for *strong* south-westerly winds, to the prevalence of which undoubtedly the comparatively high winter temperature must be ascribed, would not exist.

An anticyclone to develope its effects must be persistent, and it is not indeed surprising that the high-pressure systems which we so often experience for a brief period are frequently not productive of great cold.

Finally, as a matter of interest I might add that a recent example of a severe though short frost, accompanying conditions which must be described as typically anticyclonic, occurred in Scotland during the winter of 1902. On the mornings of the 31st of January and 1st of February of that year the centre of an anticyclone of exceptional intensity was situated off the east coast of Scotland. (Meteorological Office Reports.) At 8 a.m., January 31st, the barometer at Aberdeen stood at the unusually high level of 31·05 inches, and the air temperature at the same time was 15° F.; on the following morning the barometer at Aberdeen stood at 31·04 inches, and the thermometer at 19° F., while at Nairn at the same time temperature was as low as 10° F. and pressure as high as 31·04 inches. This cold, which was doubtless still greater further inland, accompanying light airs or calms and clear skies, was evidently directly related to the anticyclone. By the middle of February the frost had entirely disappeared from Scotland, the area of greatest

cold having by that time shifted to the south of England and the adjacent parts of the continent; on the morning of the 16th, temperature was as low as 18° F. both in London and in Paris, and the charts show that on that morning the south-east of England lay well within the influence of an anticyclone centred over the very cold region of northern Germany.

L. C. W. BONACINA.

22nd March, 1904.

THE STORMS OF MARCH 29th–30th, 1904.

A FEW notes may be of interest on the storms of the above dates as experienced in this district. On the 29th, towards 2.30 p.m., after a fairly fine forenoon, cumulo nimbus (thunder clouds), preceded by cirro-velum, gathered up. A sharp thunderstorm broke towards 2.45 p.m., and though of short duration, was very heavy while it lasted, fork and sheet lightning were especially vivid, hail of an exceptional size falling in the rear of the storm. In the evening, at 7.30 p.m., a remarkable sky of a most brilliant green hue was visible to the westward. On the 30th heavy snowstorms prevailed to noon, the snow flakes being remarkable for their size. Thunder clouds again gathered up towards 3 p.m., a storm passing over about 3.15 p.m., with almost continuous flashes of sheet and fork lightning, hail again falling, and in exposed situations the rattling of the stones on glass was very loud. Inky darkness prevailed for a short time on both occasions. A noticeable feature of both storms was the remarkable lowness of the clouds at the time.

S. C. RUSSELL.

Sutton, Surrey, April 4th, 1904.

SCOTTISH METEOROLOGICAL SOCIETY.

THE half-yearly General Meeting of this Society was held in the Philosophical Institution, Edinburgh, on March 24th, the Hon. John Abercromby presiding over a large attendance.

The report of the Council was adopted, Lord M'Laren being appointed President of the Society in place of the late Duke of Richmond and Gordon, and Sir Arthur Mitchell, K.C.B., succeeding Lord M'Laren as Vice-President. Three Members of Council retired by rotation, the vacancies being filled by the election of Professor J. G. MacGregor, and the re-election of Sir John Murray, K.C.B., and Mr. J. Y. Buchanan.

It was intimated that the Council had some time ago received a request from the German Marine Observatory (Deutsche Seewarte) for daily weather telegrams from the Ben Nevis and Fort William Observatories, to be used in connection with the daily forecasts issued from Hamburg. Arrangements were now completed, and a letter had just been received requesting that the transmission of these telegrams should commence in April. The meteorological

bureau of a foreign country would thus be the first to utilize the Ben Nevis observations in its daily weather report.

It was further intimated that it would not be possible to finance the Ben Nevis Observatories after the beginning of October of this year unless a sum of at least £600 per annum were guaranteed, in addition to the continuance of the sums of £100 and £250 which had up to that time been given by the Meteorological Council out of the Parliamentary grant.

Dr. Buchan read a paper on "The Ben Nevis Observatories in relation to Forecasting," in which he discussed some of the points dealt with in the last Report of the Ben Nevis Committee to the British Association (see this Magazine for February, Vol. **39**, p. 11), and showed what had been done in working out some of the lines of research indicated in that report. Diagrams were exhibited showing by monthly averages for each hour of the day the difference between the Ben Nevis and Fort William barometric readings when both were reduced to sea level by the usual tables. Including all observations, except those where strong winds rendered the barometric readings unsatisfactory through pumping of the mercury, the curves showed that for the greater part of the year the reduced Ben Nevis barometer came out higher than the Fort William barometer during the night and lower during the day. If, however, only those days were considered for which the mean difference of temperature between the top and bottom of the mountain exceeded 18° F., the curves showed that the reduced Ben Nevis barometer was below that for Fort William throughout, though not so much below at night as during the day. On the other hand, on days when the mean difference was small, less than 12° F., the reduced Ben Nevis barometer was higher than that at Fort William. The curves for the days when the temperature difference was between 12° F. and 18° F. lay between the curves for the extreme cases.

Lord M'Laren congratulated Dr. Buchan on his paper, and remarked upon the action of the Meteorological Office with respect to Ben Nevis.

Mr. A. Watt followed with a paper on "Sunshine at Home and Abroad." He was indebted for his material to the mean values published by the Meteorological Council, to H. König's exhaustive treatise, and to original MSS. In Scotland, and indeed in North-western Europe generally, May was the sunniest month, and it was to be noted that May was also the month of highest atmospheric pressure in that region. The May maximum was peculiarly well marked in the Orkneys—Deerness averaging about an hour more sunshine per day in May than in June (May 180 hrs., June 151 hrs.) In the South of Europe July and August were the sunniest months, and in the South of England there was an inclination to this later maximum. Comparing the climate of Davos with that of the South of England, it was found that in the course of the year Davos and such favoured places as Hastings and Torquay received about the

same amount of sunshine. The seasonal distribution, however, differed greatly. In summer the English stations were much sunnier, but from October to March Davos had 30 per cent. more sunshine, and from November to February it averaged fully an hour more sunshine per day than any place in England.

The Swiss sunshine records were of exceptional interest, as returns were available for very different heights. Thus ten years' observations for Zürich (1617 ft.), Davos (5108 ft.) and Säntis (8202 ft.) gave the following mean values, in hours:—

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Zürich...	42	94	137	171	185	223	241	243	179	111	51	43	1720
Davos ...	92	109	153	161	168	176	208	214	176	143	109	87	1796
Säntis ...	113	126	138	148	145	148	174	193	161	151	141	114	1752

Except in March, the amount for Davos was intermediate between those for Zürich and Säntis, whilst from October to February Säntis recorded the most, and from April to September the least of the three stations.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, March 16th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

The following gentlemen were elected Fellows:—Mr. Peter Anderson, Mr. Eugene André, F.R.G.S., Mr. William Henry Dobson, Mr. Thomas Price Thomas, and Mr. Hanns Vischer, M.A., F.R.G.S.

This being the "popular" meeting of the session, Mr. Richard H. Curtis, at the request of the Council, gave a lecture on "Water Vapour," which he illustrated by experiments and lantern slides.

After explaining the nature of water-vapour, the lecturer proceeded to speak of the processes of evaporation and condensation, and showed that the capacity of the air for moisture varies according to the temperature. He pointed out that the quantity of vapour present in the atmosphere varies very much in different regions of the globe, and in most places it varies also a great deal at different times and occasionally within very brief periods. It is a most important factor in Climate. There are parts of the globe where vapour is always present in great abundance, and in consequence the air is constantly damp and humid, and in a nearly saturated condition. The calm region near the Equator which marks the meeting place of the North-east and South-east Trade winds is an example of such a humid climate. On the other hand, there are regions where the quantity of vapour is always small, both relatively and absolutely. Inland regions far removed from any considerable source of supply, and subject to strong sun-heat, are generally in

this condition; and the central portions of Australia, parts of Arabia, and the desert regions of Africa, are examples of such parched and arid climates.

The amount of vapour in the air has a great deal to do with our personal comfort. A dry cold air is not so unpleasant and does not feel so cold as a damp air, although the temperature of the damp air as shown by the thermometer may be the higher. But our sensations are often at variance with the thermometer, and this is generally so because of the way in which they are affected by the vapour in the air. If the air be dry a degree of heat also can be enjoyed which would be simply unendurable if it occurred with a humid atmosphere.

Mr. Curtis referred to some phenomena of the atmosphere in which water-vapour plays a leading part, and described the formation of dew, hoar-frost, fog, cloud, halos, rain, snow and hail. He concluded by saying that he had tried to show how a particle of water may be taken from the ocean and stored away invisible in the atmosphere above it; how that particle may travel to distant parts of the globe, and then by the action of another of Nature's processes be changed back again into water, and fall once more upon the ground beneath; here it may unite itself to other similar drops, and together form a tiny stream, which may gradually grow to the dimensions of a river; and once again our drop of water may find itself a constituent part of the ocean, to repeat its pilgrimage and carry on the part it is destined to play in the economy of Nature.

METEOROLOGICAL NEWS AND NOTES.

The British Antarctic Expedition returned to Lyttelton, New Zealand, on April 1st, with all well on board. Captain Scott has thus the unique distinction of having spent two consecutive winters in the Antarctic regions at a higher latitude than any other expedition has ever penetrated, and without the loss of a man from disease. The meteorological observations cannot fail to have been of the greatest interest; and, although no particulars of the scientific results have yet been received, Captain Scott states that the work of the second year was more important than that of the first. The expedition throughout has been a brilliant success, surpassing all expectation.

In New Zealand Meteorological matters are provided for in two Government Departments:—The Climatological, or Statistical, in one (from the control of which Sir James Hector has recently retired); and the Weather, or Forecasting Branch, in another, under the charge of Captain Edwin, R.N., of the Marine Department.

The Health Resorts of New Zealand are the subject of a forthcoming work by Dr. Wohlmann, the Government Balneologist at Rotorua, the most famous sanatorium of New Zealand. It will

deal with the climate of that favoured colony, the natural beauty of the scenery of which is probably unrivalled in the southern hemisphere.

A CENTRAL WEATHER BUREAU FOR AUSTRALIA is, we understand, likely to become an accomplished fact. There is no department in which the federal government of the Commonwealth can incorporate or correlate the separate State organizations with more probability of increasing efficiency without sacrificing economy than in the treatment of Meteorology. We hope that the new meteorological system will be extended to all Australasia, including New Guinea, New Zealand and Fiji.

THE METEOROLOGICAL DEPARTMENT OF THE TRANSVAAL has, we understand, decided to present to a certain number of its observers a year's issue of this Magazine, with the object of encouraging the study of Meteorology and bringing the isolated observers in different parts of the empire into touch with one another. We are gratified in obtaining an accession to the number of our readers in a country so full of interest as the Transvaal, and hope that the exchange of experiences with fellow-observers at home will be of profit to both.

THE PHOTOGRAPH OF THE METEOROLOGICAL BREAKFAST at Southport, which was issued with the number of this Magazine for December, 1903, and intended to serve as a frontispiece to Vol. **38**, seems to have been omitted from some copies. Any reader who has received the December number without the plate is requested to return it to the Editor at 62, Camden Square, London, N.W., and a perfect copy will be sent in exchange.

SIR JOHN ELIOT ON THE METEOROLOGY OF THE EMPIRE.

THE new magazine, *Broad Views*, for March contains an instructive article by Sir John Eliot on "The Meteorology of the Empire," for the unique period 1892—1902, during which time India, Australia, and South Africa, especially suffered more severely from droughts than during any other similar period for a hundred years at least. It is estimated that in New South Wales alone some fifty million sheep perished during the almost continued drought of 1895—1902. The author deals more particularly with the meteorology of India, the primary feature of which is, as is well known, the nearly equal division of the year into wet and dry seasons. The dry period culminates about the end of May, over Northern and Central India, when day temperatures of 115° to 120° are registered. The weather conditions are completely reversed with the advent of the wet season, and in the course of a few days all nature becomes instinct with life and growth. Excessive rains, such as occurred in 1892-4, rarely affect large areas to such an extent as to destroy *crops, but* deficient rainfall, which occurred between 1895 and

1902, with the exception of 1898, especially when the falls terminate early, is very serious, and may prevent the maturing of the crops. We are unable to enter fully here into this very interesting article, but may mention the author's opinion that the next development of weather study will almost certainly be in the relation of meteorology to the phenomena of sun spots and terrestrial magnetism. He also approves of what he considers a most valuable suggestion, made by Sir Norman Lockyer, that the meteorological data from the whole Empire should be collected and dealt with by a special branch of the British Meteorological Office.

REVIEW.

Studies among the Snow Crystals during the winter of 1901–1902, *by* Mr. Wilson A. Bentley. *Reprinted from the Annual Summary of the U.S. Monthly Weather Review for* 1902. Size $11\frac{1}{2} \times 9\frac{1}{2}$. Pp. 10. *Plates.*

Mr. W. A. Bentley has devoted twenty years to the study of the forms of snow-crystals, and this contribution consists of twenty-two plates, each containing twelve micro-photographs of snow-crystals magnified about twenty diameters. Before photography was enlisted to aid the artist, the pictures of snow-crystals were necessarily rather unsatisfactory. Seen in their entirety only for a moment, it was impossible to say that any slight irregularity was natural or merely the result of melting setting in at one point before another. In the delightful series of snow-crystals published by the late Mr. Glaisher in 1855, we understand that only one ray or segment of the crystal was actually drawn from nature, the other five being filled in by copying the first. How near the truth this method came may be judged by the accompanying comparison of one of Mr. Glaisher's symmetrical drawings with one of Mr. Bentley's actual photographs of a somewhat similar form.

Drawing by Mr. Glaisher.

Photograph by Mr. Bentley.

RAINFALL AND TEMPERATURE, MARCH, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Greatest in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. Shade	No. of Nights below 32°. Grass
		inches.	inches.	in.								
I.	London (Camden Square) ...	1·72	+ ·26	·36	30	15	61·0	9	27·9	17	8	19
II.	Tenterden ...	1·47	— ·22	·32	1	14	58·0	8, 9	24·0	2	9	20
,,	Hartley Wintney ...	1·35	— ·21	·26	28	16	57·0	31	25·0	12	11	23
III.	Hitchin	1·32	— ·12	·24	28	16	57·0	9	26·0	1, 11	15	...
,,	Winslow (Addington) ...	1·45	— ·07	·25	28	16	59·0	9	25·0	12	15	26
IV.	Bury St. Edmunds (Westley)	1·55	— ·08	·30	29	16	63·0	19	24·0	17	17	...
,,	Brundall	1·93	+ ·32	·50	28	19	60·0	19	24·2	...	9	18
V.	Alderbury ...	1·39	— ·29	·31	4	12	52·0	9	26·0	15	12	...
,,	Winterborne Steepleton ...	1·85	...	·53	7	11	59·1	9	25·3	16	11	17
,,	Torquay (Cary Green) ...	2·03	...	·62	4	15	58·6	9	32·5	1, 12	0	17
,,	Polapit Tamar [Launceston]	2·14	— ·14	·66	7	12	57·1	9	23·1	12	13	16
,,	Bath ...	1·86	...	·55	4	16	59·5	9	25·5	12	1	2
VI.	Stroud (Upfield) ...	1·57	— ·11	·38	28	16	57·0	23	29·0	1, 2, 11	10	...
,,	Church Stretton (Woolstaston)	1·57	— ·20	·36	7	21	57·0	20	24 5	1	17	...
,,	Bromsgrove (Stoke Reformatory)	1·03	— ·22	·22	7	15	54·0	20	23·0	1	19	...
VII.	Boston ...	1·21	+ ·02	·20	8, 14	12	58·0	20	26·0	18	15	...
,,	Bawtry (Hesley Hall) ...	1·64	+ ·24	·44	7	18	60·0	20	23·0	12	...	...
,,	Derby (Midland Railway)...	1·57	+ ·15	·40	7	20	58·0	20	24·0	11	14	...
VIII.	Bolton (The Park) ...	2·34	— ·38	·29	13	18	54·2	20	26·9	1	9	22
IX.	Wetherby (Ribston Hall) ...	1·94	+ ·31	·57	7	19	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	4·65	— ·47	1·59	28	23	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	1·85	+ ·19	·39	14	19	59·0	20	26·0	18	8	21
X.	Newcastle (Town Moor) ...	1·38	— ·56	·20	7	18	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	12·51	+ 1·85	3·73	20	17	...	...	...	...	...	...
XI.	Cardiff (Ely)	2·73	+ ·17	·73	7	18	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	2·29	— ·45	·55	7	15	52·6	23	26·5	12	8	15
,,	Aberystwith (Gogerddan)..	2·12	— ·72	·28	18	14	60·0	9	22·0	10*a*	14	...
,,	Llandudno ...	1·31	— ·63	·40	13	11	55·0	19	29·0	15	5	...
XII.	Cargen [Dumfries] ...	3·48	+ ·43	1·08	28	15	53·0	23, 24	25 0	11	14	...
XIII.	Edinburgh (Royal Observy.)	1·07	...	·24	20	17	55·4	19	26·6	1	13	23
XIV.	Colmonell	2·50	— ·74	·60	20	11	55·0	19	23·0	10	12	...
XV.	Tighnabruaich ...	3·91	...	·75	31	15	48·0	23	25·0	10	23	21
,,	Mull (Quinish) ...	3·95	— ·22	·94	27	15	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	2·13	— ·45	·38	8	13	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	1·75	— ·23	·35	28	18	53·4	20	28·3	31	16	...
XVII.	Braemar ...	1·35	— ·97	·32	22	14	52·3	24	18·2	2	23	29
,,	Aberdeen (Cranford) ...	2·94	+ ·74	1·00	28	18	51·0	19	24 0	14, 23	16	...
,,	Cawdor (Budgate)	·63	— 1·61	·36	22	8	...	...	...	...	...	...
VIII.	Glencarron Lodge	3·05	— 3·89	·64	21	18	51·9	17	22·0	1	15	...
,,	Bendamph ...	5·68	— 2·43	·96	13	15	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	1·53	— ·91	·53	22	11	55·0	19	25·0	1	14	...
,,	Castletown	1·93	...	·47	7	19	55·0	19	24·0	1	17	...
XX.	Killarney ...	3·56	+ ·36	·74	21	14	57·5	23	25·5	2	...	...
,,	Waterford (Brook Lodge)...	3·61	+ 1·09	·76	20	20	56·0	23	25·0	12	9	...
,,	Broadford (Hurdlestown) ...	2·51	+ ·31	·60	20	16	54·0	19	28·0	15	7	...
XXI.	Carlow (Browne's Hill) ...	2·29	+ ·08	·73	20	16	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	2·09	+ ·27	·52	7	19	60·8	19	28·9	11	3	13
XXII.	Ballinasloe	2·88	+ ·46	·65	20	19	64·0	16, 19	18·0	2	15	...
,,	Clifden (Kylemore House)..	5·74	+ ·55	·95	27, 28	14	...	...	...	...	...	...
XIII.	Seaforde	2·41	·00	·57	20	19	57·0	19	23·0	10	14	17
,,	Londonderry (Creggan Res.)	2·12	— ·57	·39	31	16	...	...	...	...	...	...
,,	*Omagh (Edenfel)* ...	2·99	+ ·41	·45	20	17	55·0	23	23·0	10	14	21

+ *Shows that the fall was above the average*; — *that it was below it.* a and 11, 23. b and 10, 11.

SUPPLEMENTARY RAINFALL, MARCH, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·60	XI.	New Radnor, Ednol	2·60
,,	Sheppey, Leysdown	1·48	,,	Rhayader, Nantgwillt	3·05
,,	Hailsham	1·19	,,	Lake Vyrnwy	2·82
,,	Crowborough	1·36	,,	Ruthin, Plâs Drâw	2·26
,,	Ryde, Beldornie Tower	·93	,,	Criccieth, Talarvor	2·61
,,	Emsworth, Redlands	1·01	,,	Anglesey, Lligwy	2·16
,,	Alton, Ashdell	1·63	,,	Douglas, Woodville	3·07
,,	Newbury, Welford Park	1·56	XII.	Stoneykirk, Ardwell House	2·50
III.	Harrow Weald	1·59	,,	Dalry, Old Garroch	4·18
,,	Oxford, Magdalen College	1·12	,,	Langholm, Drove Road	5·93
,,	Banbury, Bloxham	1·56	,,	Moniaive, Maxwelton House	3·46
,,	Pitsford, Sedgebrook	1·42	,,	Lilliesleaf, Riddell	2·34
,,	Huntingdon, Brampton	1·46	XIII.	N. Esk Reservoir [Penicuick]	3·05
,,	Wisbech, Bank House	1·34	XIV.	Maybole, Knockdon Farm	2·11
IV.	Southend	1·36	,,	Glasgow, Queen's Park	1·68
,,	Colchester, Lexden	1·55	XV.	Inveraray, Newtown	3·77
,,	Saffron Waldon, Newport	1·40	,,	Ballachulish, Ardsheal	5·89
,,	Rendlesham Hall	1·44	,,	Campbeltown, Redknowe	2·41
,,	Swaffham	1·49	,,	Islay, Eallabus	3·08
,,	Blakeney	1·40	XVI.	Dollar	1·57
V.	Bishop's Cannings	1·57	,,	Balquhidder, Stronvar	...
,,	Ashburton, Druid House	3·30	,,	Coupar Angus Station	1·90
,,	Okehampton, Oaklands	3·11	,,	Blair Atholl	1·67
,,	Hartland Abbey	1·87	,,	Montrose, Sunnyside	2·11
,,	Lynmouth, Rock House	3·28	XVII.	Alford, Lynturk Manse	1·96
,,	Probus, Lamellyn	2·60	,,	Keith, H.R.S.	·93
,,	Wellington, The Avenue	2·08	XVIII.	Fearn, Lower Pitkerrie	·41
,,	North Cadbury Rectory	1·53	,,	S. Uist, Askernish	2·48
VI.	Clifton, Pembroke Road	2·17	,,	Invergarry	3·13
,,	Moreton-in-Marsh, Longboro'	1·78	,,	Aviemore, Alvie Manse	1·22
,,	Ross, The Graig	1·70	,,	Loch Ness, Drumnadrochit	1·04
,,	Shifnal, Hatton Grange	1·68	XIX.	Invershin	·80
,,	Wem Rectory	1·59	,,	Altnaharra	1·48
,,	Cheadle, The Heath House	1·73	,,	Bettyhill	·48
,,	Coventry, Kingswood	1·58	,,	Watten, H.R.S.	·94
VII.	Market Overton	1·71	XX.	Cork, Wellesley Terrace	2·55
,,	Market Rasen	1·79	,,	Darrynane Abbey	3·41
,,	Worksop, Hodsock Priory	1·72	,,	Glenam [Clonmel]	2·66
VIII.	Neston, Hinderton	1·61	,,	Ballingarry, Hazelfort	2·54
,,	Southport, Hesketh Park	2·02	,,	Miltown Malbay	3·35
,,	Chatburn, Middlewood	2·86	XXI.	Gorey, Courtown House	3·01
,,	Duddon Valley, Seathwaite Vic.	6·22	,,	Moynalty, Westland	3·24
IX.	Langsett Moor, Up. Midhope	2·92	,,	Athlone, Twyford	2·94
,,	Baldersby	1·72	,,	Mullingar, Belvedere	3·38
,,	Scalby, Silverdale	1·89	XXII.	Woodlawn	3·05
,,	Ingleby Greenhow Vicarage	2·38	,,	Westport, Murrisk Abbey	3·02
,,	Middleton, Mickleton	1·75	,,	Crossmolina, Enniscoe	3·75
X.	Beltingham	2·24	,,	Collooney, Markree Obsy	2·46
,,	Bamburgh	1·77	XXIII.	Enniskillen, Portora	2·86
,,	Keswick, The Bank	3·39	,,	Warrenpoint	2·87
,,	Melmerby Rectory	1·80	,,	Banbridge, Milltown	1·71
XI.	Llanfrechfa Grange	1·93	,,	Belfast, Springfield	2·01
,,	Treherbert, Tyn-y-waun	4·25	,,	Bushmills, Dundarave	1·62
,,	Llandovery, Tonn	1·77	,,	Stewartstown	2·33
,,	Castle Malgwyn	1·68	,,	Killybegs	2·32
,,	Llandefaelog-fach	2·20	,,	Horn Head	1·81

METEOROLOGICAL NOTES ON MARCH, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm. R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The first week was practically sunless, with frequent but light R. From 8th there was a considerable amount of sunshine, and very little R until the last few days, when slight TSS occurred with some H. Duration of sunshine 62·3 hours and of R 41·7 hours. Mean temp. 40°·8, or 1°·3 below the average.

ABINGER HALL.—Moderately fine but not much sun. Ground wet and cold for seeds, and low germination. Sunshine greatly needed.

TENTERDEN.—Dull and cold generally but mostly dry. Wind N. and E., except about 14th, 21st and 28th, but not of much force. S on 1st, 2nd and 30th. Duration of sunshine 102 hours.

SHEPPEY, LEYSDOWN.—The first and last weeks were rainy and unsettled. Cold N.E. wind from 22nd to 27th. About 3 inches of S on 1st.

CROWBOROUGH.—R below the average and temp. low. From 8th to 23rd it was fairly mild, but the remainder was very cold. Mean temp. 39°·0. Prevailing wind E. and N.E. L, T, H, S and R on 30th.

HARTLEY WINTNEY.—Quiet and free from wind and dust. The first week was foggy and showery, followed by a dry and cold fortnight. Sleet showers in the last week and heavy H storm with T on 29th. Ozone on 20 days with a mean of 5·9.

WINSLOW, ADDINGTON MANOR.—Wintry weather at the beginning with S. Frost on many nights but never severe. Much H and rough wind on 30th.

PITSFORD.—R ·28 in. below the average of 10 years. Mean temp. 39°·7.

COLCHESTER.—Almost continuous E. wind till 18th, with much sunshine but few warm days. The land was in excellent condition, but the season rather late.

BRUNDALL.—A fair average March, the mean temp. being only 0°·1 below the normal. Vegetation at the close was quite a month behind 1903.

WINTERBOURNE STEEPLETON.—Cold and dry, with mean temp. 2°·3 less than the average of 11 years. The wind was N. or E. for nearly the whole month. The dry weather was very beneficial for farm work.

TORQUAY.—R ·56 in. below the average. Duration of sunshine 124 3 hours, or 15·3 hours below the average. Mean temp. 43°·4, or 0°·7 below the average. Mean amount of ozone 4·5.

LYNMOUTH.—The first week was cold, with S and R on 4th and 5th. T and L on 9th. In the middle of the month there was a good deal of sunshine. Gales from N.W. in the last week, and T and L at 8 a.m. on 29th.

WELLINGTON.—After the 9th set in one of the driest periods experienced for a considerable time, lasting for nearly three weeks. The last four days were stormy and unsettled.

NORTH CADBURY RECTORY.—Very seasonable; dry and unusually calm, with normal temp. and no strong wind. Except the first 7 and last 4 days the weather was very pleasant, and being practically rainless was of enormous benefit to agriculture.

CLIFTON.—R or sleet every day till 9th and very cold till 7th with N.E. winds and slight frosts. Then warmer with occasional slight R. Last few days stormy. Heavy TS from 6 to 7 p.m. on 9th.

ROSS.—The first week was wet and very cold, and from 8th to 23rd principally warm, fine and dry. Cold, rainy and unpleasant in the last week.

WORKSOP, HODSOCK PRIORY.—Dull and rather cold with normal R. Showers kept the ground moist and the proverbial "peck of March dust" did not appear.

BOLTON.—Cold, with N. or E. wind on 17 days. The R was below the average, and this, with the drying wind, was beneficial to agriculture. Mean

temp. 37°·9, or 1°·5 below the average. Duration of sunshine 47·5 hours, the least on record.

SOUTHPORT.—Quiet, dull and rather cool, with high bar. and easterly airs. Mean temp. 2°·0 below the average. Duration of sunshine 29 hours less than the average, and R ·12 in. below the average. Underground water exceptionally high. Remarkably little ozone.

LLANFRECHFA GRANGE.—Cold and wet, with very little dry wind. The land was too wet to work and grass not growing. Sharp T and L at 7 p.m. on 9th.

HAVERFORDWEST.—Commenced cold and frosty with a wintry sky, and although a few days were mild, it continued cold throughout, the max. temp. reaching 50° on only three days. Duration of sunshine 78·4 hours. Agricultural operations fairly well advanced.

ABERYSTWITH, GOGERDDAN.—The early part was dry but rough; the middle dull, wet and calm; but towards the end it became somewhat drier. Little sunshine.

DOUGLAS.—Cold, the temp. being persistently low throughout. Wet, very sunless and thoroughly unseasonable, with a remarkable absence of wind. Hardly a sign of spring and no fruit blossom.

SCOTLAND.

CARGEN.—Wet, cold and sunless, with vegetation very backward and farm work at a standstill.

MAXWELTON HOUSE.—Another cold month. Mean temp. 37°·0, or 5°·0 below the average. The first half was cold and bright, the latter cold and wet, with a fine bright interval from 23rd to 27th. A backward season.

LILLIESLEAF.—R ·18 in. above the average. There were two periods of cold: from 1st to 15th, and from 21st to the end. The S and cold winds were much against grass and garden growth.

COUPAR ANGUS.—R slightly below the average. Mean temp. 38°·6, or 1°·0 below the average. Several severe morning frosts. Strong winds but no gales.

DRUMNADROCHIT.—R the lowest in 19 years, being 2·05 in. below the average of that period.

ALTNAHAREA.—Exceptionally fine, with bright sunshine for the greater part, but some storms towards the end.

CASTLETOWN.—The first part was cold, with S.E. winds, and S from 5th to 7th. The middle and latter part were fairly dry, with cold winds and some "March dust." Farmers were taking up last autumn's potato crop.

IRELAND.

MILTOWN MALBAY.—Not satisfactory for tillage. The last week was very rainy, with H and S, driven by squalls verging on storm force.

DUBLIN.—Generally cold and changeable. Mean temp. 42°·7, or exactly that of January and 0°·7 below the average for March. Duration of sunshine 101 hours. H on 7 days.

MARKREE OBSERVATORY.—Very fine throughout, with frost on many nights. The last few days were very stormy, with H, sleet and frequent S.

OMAGH, EDENFEL.—Up to 27th the weather was generally clear, calm and rainless; many days would have done no discredit to the Riviera. Much grain was sown and farm work was proceeded with, but the inevitable change came towards the end and the weather for the last five days was literally terrible.

BATH METEOROLOGICAL OBSERVATIONS.

In the present number, observations at Bath appear for the first time in the Table on p. 56. It is convenient to place on record the values for the preceding months of 1904.

January	3·20	...	·46	13	22	55·0	13	23·2	23	5	8
February.....	3·61	...	·47	10	23	54·6	21	24·5	29	2	6

Climatological Table for the British Empire, October, 1903.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	65·2	2	36·0	24	59·1	47·8	48·9	87	109·2	29·0	6·03	26	7·2
Malta	83·1	13	54·8	26	76·3	63·0	62·8	85	131·8	40·2	·25	3	3·3
Lagos, W. Africa	88·0	31	70·0	17*b*	84·8	73·9	74·5	78	148·0	69·0	6·87	12	5·0
Cape Town	78·0	22	38·5	18	63·9	49·1	50·2	78	...	...	3·73	15	5·8
Durban, Natal	93·4	17	54·0	20	78·5	61·8	...	...	143·9	...	1·16	12	4·9
Mauritius	82·0	23	57·2	6	78·7	63·2	59·9	69	147·2	48·4	1·20	20	5·9
Calcutta	90·9	4	66·9	27	87·0	74·9	73·9	80	155·0	61·7	8·02	14	5·7
Bombay	91·5	24	72·4	3	87·2	76·6	73·7	77	140·5	61·9	5·91	6	4·0
Madras	94·0	12	67·9	29	88·5	75·1	73·7	82	143·2	67·0	8·84	15	5·2
Kodaikanal	67·5	20	47·4	27	63·5	51·3	50·7	83	140·1	35·3	5·65	10	6·8
Colombo, Ceylon	89·6	14	72·8	16*c*	86·4	76·0	73·9	84	151·2	70·8	11·17	23	7·1
Hongkong	87·1	26	57·4	29	81·5	72·2	66·1	70	137·5	...	1·66	4	6·0
Melbourne	87·7	11	40·8	3	70·2	50·8	48·7	69	149·8	31·6	2·77	14	5·9
Adelaide	94·8	30	41·5	2	74·9	53·0	46·4	53	149·4	36·7	·66	9	4·7
Coolgardie	89·1	25	39·2	9	75·3	48·7	43·0	49	158·1	29·7	·46	6	4·2
Sydney	77·9	13	48·8	4	66·6	55·3	54·3	77	116·0	43·4	4·12	19	6·4
Wellington	72·4	23	42·0	5	63·9	50·7	47·4	70	133·0	29·0	·67	7	7·0
Auckland	72·0	31	51·5	5	64·6	55·5	52·4	76	131·0	48·0	3·27	14	6·0
Jamaica, Negril Point	90·2	13	71·1	16	87·3	73·8	73·5	79	...	...	4·71	14	...
Trinidad	91·0	7*a*	68·0	9*d*	89·2	70·7	74·0	82	166·0	66·0	2·12	5	...
Grenada	87·4	8	70·0	13	84·7	75·1	72·9	78	153·0	...	9·11	23	3·3
Toronto	73·9	7	27·9	27	59·5	42·1	45·1	78	...	...	2·78	10	5·7
Fredericton	71·3	1	34·9	30	53·6	34·9	34·1	62	...	...	4·14	11	6·1
Winnipeg	69·0	29	15·4	26	56·8	33·1	...	...	...	...	·69	5	4·3
Victoria, B.C.	65·7	12	37·3	3	57·0	45·5	...	...	...	...	1·77	14	6·4
Dawson	43·0	4	4·1	15	26·6	15·0	..	...	..	...	1·25	6	4·6

a and 8, 10. *b* and 21. *c* and 17. *d* and 10, 13.

MALTA.—Mean temp. of air 68°·3 or 1°·1 below, mean hourly velocity of wind 6·7 or 2·2 below, average. Mean temp. of sea 72°·7. L on 3 days.

Mauritius.—Mean temp. of air 1°·8, dew point 2°·0, and R ·37 in. below, average. Mean hourly velocity of wind 12·1 miles, or 1·0 above average.

KODAIKANAL.—Mean temp. of air 55°·8. Mean velocity of wind 273 miles per day. Bright sunshine 135·9 hours.

COLOMBO, CEYLON.—Mean temp. of air 80°·5 or 0°·3 above, of dew point 0°·9 above, and R 3·39 in. below, average. Mean hourly velocity of wind 10 miles, prevailing direction S.W. T88 on 10 days.

HONGKONG.—Mean temp. of air 76°·1. R 3·70 in. below average. Bright sunshine 174 hours or 40 below average. Mean hourly velocity of wind 13·9 miles; prevailing direction N.E. by E.

Adelaide.—Mean temp. of air 1°9 above, R 1·09 in. below, average. Moderately dry over agricultural areas.

Sydney.—Mean temp. of air 2°·5 below, humidity 8·2 above, and R 1·13 in. above, average.

Wellington.—*Mean temp.* of air 3°·7 above, and R 3·70 below average.

TRINIDAD.—*R 4·65 in. below* 40 years' average.

Symons's
Meteorological Magazine.

No. 460. MAY. Vol. XXXIX.

THE TRANSVAAL METEOROLOGICAL SERVICE.

We have been favoured with the following authoritative account of the new Meteorological Service of the Transvaal, the Director of which is Mr. R. T. A. Innes. It is extremely gratifying to find how energetically the work is being carried on, and we feel sure that meteorologists in all countries will read these notes with interest and pleasure :—

In November, 1902, the Transvaal Government decided to establish a Meteorolgical department. The Director of the new department entered on his duties in April, 1903. Orders were at once sent to England for meteorological instruments for the second and third order stations. These arrived in the second half of 1903, and have been distributed. A site was secured for the observatory three miles north-east of Johannesburg, on a range of hills—it was partly purchased, but more largely presented, by the Bezuidenhouts, a Dutch family. The grounds cover 10½ acres, and are about 5900 ft. above sea-level. The observatory is now built.

There are already 200 rainfall stations in operation, in addition to about thirty stations of the second and third order. The rainfall observers send postcards on the morning after each rainfall. These observers have all come forward voluntarily. Many are farmers or school teachers, in thinly populated districts. Some 25 of the observers send daily weather telegrams to headquarters. Daily telegrams are also exchanged with the meteorological services of the neighbouring colonies, viz. : with Cape Town, Durban, Bloemfontein, and Salisbury, the first named including returns from half-a-dozen stations. A weather report, based on these telegrams, is issued every day at noon. The report appears in the evening journals. A letter code for telegrams has been introduced, which permits the observer to send the rainfall in three figures, state of sky, wind force and direction, prevailing weather, wet and dry bulb and maximum and minimum thermometers, barometer to thousandths of an inch, with attached thermometer, in a total of 16 letters.

Continuously recording instruments for the observatory are now on the way to South Africa, and it is hoped that they will all be in working order by the 1st of July next, the date of the commencement of the Transvaal meteorological year.

E.

Symons's Meteorological Magazine.

THE VARYING DISTRIBUTION OF ATMOSPHERIC PRESSURE OVER THE SURFACE OF THE EARTH.

By L. Bonacina.

The precise distribution of atmospheric pressure that prevails at any instant of time over the Earth's surface must be regarded as the product of the following agents: (*a*) the distribution of the intensity of solar and terrestrial radiation over the surface of the globe; (*b*) the general circulation of the atmosphere; (*c*) the distribution of pressure that has previously prevailed; (*d*) the rotation of the Earth upon its axis.

When we consider these headings separately their meaning will be rendered clearer. With regard to (*a*) it is, of course, unnecessary to remark that all atmospheric changes have their ultimate origin in the sun's rays, which by exciting differences of temperature and of vapour tension, and consequently of pressure, set the air in motion, and thus engender the endless sequence of weather changes which it is the province of the meteorologist to investigate. Moreover, that the influence of terrestrial radiation is very considerable in modifying the distribution of atmospheric pressure is shown by the fact, that during the winter months over all the great continental land masses, which in virtue of the low specific heat of the rocks of which they are composed lose their heat very rapidly, pressure is relatively high,* and remains so, till upon the advent of spring the solar rays gain sufficient power to dislodge the cold dense masses of air.†

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* Over central Asia the mean barometric height during the month of January is above 30·5 inches, and over central North America above 30·2 inches. During the southern winter in the month of July pressure over Australia increases to 30·1 inches, over South Africa to 30·2 inches, and over Paraguay and northern Argentina to 30·1 inches. As, however, the continental lands of the southern hemisphere lie much nearer the equator, and cover a much smaller area than those of the northern hemisphere, the lowering of temperature over them is nowhere sufficient to render pressure higher than over the sea, and, accordingly, the anticyclones of the South Atlantic, South Pacific, and South Indian oceans retain their positions, but become increased both in intensity and size, expanding so as to embrace the continental lands within their influence.

† It must, of course, be remembered that a reduction of temperature over a given area involves an increase of atmospheric pressure only because the air over it contracts, sinks, and thereby receives accessions to its mass from above, there being at the same time an outward underflow at the surface of the ground. Similarly, a rise of temperature over any given area implies a decrease of atmospheric pressure in consequence merely of the fact that the expanded air overflows at higher levels, and thereby loses a portion of its mass, there being, meanwhile, an influx of air at lower levels to supply the deficit. If these conditions were not realised the air would simply expand or contract at constant pressure.

When the temperature of a mass of gas kept at constant volume is raised its pressure increases, because the kinetic energy of its molecules, the number of their impacts per unit time against the sides of the containing vessel, is increased. When at sunrise the temperature of the air rises, the first effect is

With regard to heading (*b*) little more can be said than that the general circulation of the atmosphere is *ipso facto* responsible for the complex nature of that circulation, and that the cyclonic eddies, which are constantly disturbing the atmosphere, originate in the forward motion of the air as a whole. Of the mathematical laws upon which this complex circulation depends we are, of course, profoundly ignorant.*

Under heading (*c*) we have to discuss what is undoubtedly the cause of the variability in the character of the weather experienced during corresponding seasons of different years. Why does not precisely the same distribution of atmospheric pressure prevail all over the globe at corresponding dates every year when the Earth is in the same relative position with regard to the sun, and when, therefore, the atmosphere might be expected to circulate in the same manner, that is to say to produce similar eddies in the same places? Obviously the reason is that the distribution of pressure that prevails at any instant of time is, in some obscure manner, dependent upon the distribution which preceded it, and is in turn responsible for the type of distribution that will succeed it; in other words, we are forcibly driven to the conclusion that had the weather that prevailed, for example, ten years ago been of a different character, so likewise would the general character of the weather we are now experiencing be somewhat different. The knowledge of this dependence of one type of weather upon another is, of course, of little use to us in the work of forecasting weather changes, because we do not know *how* one type is related to another.

The difficulties which beset us when we endeavour to ascertain how, for example, the easterly type of weather that may have been conspicuous in England one month was related to the westerly type that may have prevailed the previous month, or how, again, a cyclone situated over the British Islands is related to an anticyclone that may be dominating the atmospheric conditions over Australia, are well nigh insurmountable. Moreover, when we discuss the minutiæ of synoptic charts we find that the various forms of distribution of atmospheric pressure, although capable of classification under a few well-marked types, are really infinite in number. Two synoptic charts, for example, constructed on two occasions, separated by a longer or shorter interval of time, might reveal a distribution of pressure so similar, that we should be tempted to base our predictions upon the second occasion upon our experience of the changes which followed after the first occasion. Yet there would be slight

an increase of atmospheric pressure, but afterwards as the rise of temperature continues and the air expands and overflows, pressure decreases in consequence of the greatly diminished density of the air, the fall of pressure from this cause being greater than is counterbalanced by the increase due to the higher temperature. [But see this Magazine, Vol. **36** (1901), p. 93. Ed. *S. M. M.*].

* When we reflect upon the infinite complexity of the motion of the water of a mountain torrent, for instance, need we wonder that the movements of the atmosphere are indeed inexplicable?

differences between the distribution of pressure on these two occasions, not indicated by the charts, that might suffice to be the precursors of quite a different set of atmospheric changes, and finally of the establishment of opposite types of weather. This is the chief source of the failures which discredit the science of weather prognostication. Moreover, as it is impossible to construct weather charts showing the simultaneous distribution of pressure over every small portion of the Earth's surface, we shall never be able, by the method of synoptic charts, to forecast atmospheric changes with the near approach to certainty with which we can predict the occurrence of many astronomical phenomena. We are now able to establish the following proposition: every locality would experience the same weather at corresponding times every year when its position with regard to the sun is the same, if it were not for the fact that one type of pressure distribution is *à posteriori* related to that which prevailed previously. In other words, it is this unknown relationship that causes, for instance, the character of two successive winters in England to be so dissimilar, and which prevents any two seasons, however similar, from being absolutely alike.

The cold wet summer which characterised the year 1903 in Britain was, so far, related to the mild open winter which preceded it, that any difference in the general character of the latter would have necessitated a difference in the general character of the former in accordance with the unknown laws which control the sequence of weather types. Since, however, one type of weather merges by insensible gradations into another, and since the various forms of distribution of atmospheric pressure are, when minute differences are taken into consideration, numerically infinite, so that at no two points of time have the atmospheric conditions over the globe ever been identical (though, of course, often very similar), it is manifestly impossible to predict the weather of a coming season. If, for example, we were to experience another winter very similar to that of the year 1903 we should not be justified in expecting the following summer to resemble that of the year 1903, inasmuch as small differences between any two seasons are adequate to produce quite disproportionate differences between the succeeding seasons.

Finally, under heading (*d*) we shall consider the potent influence exerted by the rotation of the Earth upon its axis in modifying the general circulation of the atmosphere, and therefore the distribution of barometric pressure.

The effect of the rotation of the Earth upon any current of air is to cause it to deviate to the right in the northern hemisphere, to the left in the southern, of the direction in which it would travel were it subjected to the influence of the disturbing force alone. If it were not for the axial rotation of the Earth, cyclonic disturbances, such as we know them, would not exist, for whatever may be the cause of the initial reduction of pressure, which renders the formation of *cyclones possible*, it is the rotation of the Earth, which by causing

the wind to heap up masses of air to the right of its path (to the left south of the equator) greatly exaggerates the original atmospheric depression, and increases both the size and intensity of low-pressure systems.† Moreover, the great anticyclonic centres, situated more or less permanently over the oceans in about latitude 30° N. and S., owe their origin to the axial rotation of the Earth. In conclusion we would observe that the retardation of the rotation of the Earth upon its axis, caused by the oceanic tides raised by the moon, must be extremely slowly modifying the circulation of the atmosphere, and consequently the climatic conditions of the planet.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

SOME WEATHER PROPHETS.

I QUITE agree with Mr. William Ellis, F.R.S., as to the inadvisability of publishing *crude and ill-considered theories* upon any subject, especially that of Meteorology, in which great *ignorance is shown of the conditions of the weather problem as well as of the proper method of treating it* among scientific men, especially those connected with the Royal Society, the Greenwich Observatory, and the Royal Meteorological Society.

Mr. Ellis is wrong if he thinks (as he appears to do) that he possesses complete knowledge on the subject. I should like to know who told him, and upon what authority he asseverates, that the moon does not attract the atmosphere. He gives no proof for this dogmatic assertion. He says rightly that the water of the ocean is attracted by the moon, but he excludes the ocean of air from that attraction, and it appears also the solid Earth, for he ridicules the idea that the moon can have any influence in the production of earthquakes and volcanic eruptions. The atmosphere, the hydrosphere, and the lithosphere are all composed of matter and are obedient to the great law of universal attraction, under which law every particle of matter attracts every other particle of matter directly as the mass and inversely as the square of the distance. This is the Newtonian law, but it appears Mr. Ellis has a law of his

† When once the essential condition for the formation of a cyclonic eddy, namely, a slight diminution of pressure, has been established, the atmospheric depression is further increased by (*a*) the rotation of the Earth, (*b*) the ascending motion of the air, (*c*) centrifugal force. Theoretically the air, in some portions of a cyclone, must be in a compressed state; the effect of this must be (1) to increase the steepness of the barometric gradients, (2) to render pressure in the portion where aërial compression exists higher than it otherwise would be, the increase of pressure due to compression serving to counteract the much greater reduction of pressure which, from other considerations, we should expect to observe in a cyclone.—(See P. Marc Dechevrens, "Les Variations passagères de la Température," pp. 29 and 30.)

own, denying the properties of matter to the atmosphere. This Elysian law is the outcome of his complete knowledge of the laws of Nature, and gives him the authority to teach other more benighted individuals that weather is not the result of the attraction of the atmosphere by the combined influences of the moon and sun, but that all weather changes are caused by the heat of the sun. This is altogether erroneous teaching, as the sun's heat is used up in the process of radiation and the work done in evaporation, by which, at enormous expense of solar heat, the particles of water are separated against the cohesive power binding them together. By my work and experience I have found that the amount of solar heat is constant, and that the variations of temperature on the Earth's surface are due to the varying amounts of sun's rays cut off by tidally produced clouds.

During the last twenty years I have correctly predicted the weather for both long and short periods. A man like Mr. Ellis, who professes to believe that I predicted the weather correctly for 153 successive days by mere guessing, is capable of believing anything.

Science admits no authority, no dogmatism, like that of Mr. Ellis and the sun's heat, but deals with facts based upon experiment and verification. The late Mr. Symons stated that we should gladly receive the solution of the great weather problem from any person. Now I claim to have solved the problem of not only weather changes but also the incidence of great tides and earthquakes. In fact, I have found and proved by experiment that the atmosphere, the hydrosphere, and the lithosphere are tidally affected by the moon and the sun. And in order to establish this fact, I am prepared to predict the weather correctly by the tidal action of those great luminaries for any day or days in the future, if Mr. Ellis will be good enough to form a committee to adjudicate upon the result.

HUGH CLEMENTS.

With much that Mr. Ellis says in his paper on "Some Weather Prophets," one may heartily agree. But there are two passages which seem to call for protest. He says (p. 46) that "by no known method, by reference to no celestial body whatever, can the character of the weather, for any length of time in advance, be foretold"; and he wonders apparently at the stupidity of those who "can persevere in a task at present so utterly hopeless as the endeavour," &c. Now, we have surely got beyond this. Is it not a fact that this forecasting of distant weather (one of the great aims, surely, of meteorology) is a problem regarded by many of our leading men with considerable hopefulness? Why this growing interest in the question of sunspots and weather, if there is not some reasonable hope of establishing definite relations between these, and, as a result, gaining light on future weather? Here, *e.g.*, are three names whose eminence none will dispute—Buchan, Eliot, Von Bezold. Dr. Buchan,

we know, has recently offered evidence that the rainfall in Scotland is ruled by the sun-spot cycle (most rain with maxima). Sir John Eliot, as you tell us (p. 55), thinks "the next development of weather study will almost certainly be in the relation of meteorology to the phenomena of sun-spots and terrestrial magnetism." Again, at a recent triennial gathering of meteorologists in Germany, I find the president, Professor von Bezold, saying, very similarly, that "among the most important tasks of the near future is the explanation of the connection between the sun-spot frequency and terrestrial temperature." Can it be said, in view of such facts, that the forecasting of distant weather is a problem "utterly hopeless"?

Again, we are favoured, once more, with that old, but not (I think) venerable, syllogism: Weather changes are exclusively an effect of heat; the moon gives no sensible heat; therefore the moon has nothing to do with weather changes. It is difficult to see how anyone can know all that. But what I wish rather to call attention to is, that hopeful interest in the moon as a factor in weather seems also to be growing. I might cite Dr. Russell, of Sydney Observatory, as having recently argued for lunar influence. And in the newspaper account of the German meeting (already quoted) I read that Prof. Möller, of Brunswick, lectured on the atmospheric flow and ebb movements as connected with the moon, &c., and Prof. Börnstein, of Berlin, demonstrated on a paper model how the air pressure varies with different lunar phases and positions of the sun.

There is, in truth, a growing body of evidence of lunar action; and unless we are to suppose many able minds strangely misled, we may reasonably demur to that summary dismissal of the subject which your critic recommends to us.

A. B. M.

I HAVE read the letters of Mr. Hugh Clements and of A.B.M. The principal impression produced is that they might to some extent have been couched in more courteous language. Otherwise there seems to be little to remark. I can only suggest some further study of what is set out in the article that appears in the April number of the Magazine. To have supported by evidence the statements contained therein would have occupied much more space than was likely to be at my disposal, besides this was scarcely necessary, since they refer to what is common knowledge in the scientific world, as depending on the proper discussion of observed facts.

A few words may, however, be added on some misconceptions. I have not said "that the moon does not attract the atmosphere." The discussion of barometric observations at St. Helena by Sabine, and at Singapore by Elliot, given in papers appearing respectively in Vols. **137** and **142** of the *Philosophical Transactions*, shows that the total lunar effect is less than the one-hundredth part of an inch: an amount altogether insignificant as compared with other disturbances to which the atmosphere is subject. It was not mentioned by

me because so minute an effect could be of no conceivable use in the practical forecasting of weather. Neither did I ridicule the idea of the moon having "influence in the production of earthquakes and volcanic eruptions." I say they cannot be predicted so accurately as eclipses of the sun and moon, which Mr. Clements seems to claim. Further, I have in no way suggested that any of Mr. Clements' predictions were mere guessing. I simply wished to show that if the weather were set down, day by day, at random, how not unfrequently there might be such agreement as would lead some people (whom a few coincidences seem to convince) to suppose that the predictions were the result of scientific method. Again, like the late Mr. Symons, I would gladly see the solution of the great weather problem. But I am not aware that any solution has yet been arrived at by which weather can be predicted for long periods in advance.

A. B. M. asks in his letter whether the forecasting of the weather is not a problem to be entertained "with considerable hopefulness." Certainly, as a thing to be desired, but at present we are a very long way indeed from anything of the kind, and future weather remains yet an unsolved problem. This does not mean that we do not all honour the well known and revered names, cited by A. B. M, of those who have distinguished themselves in the endeavour to deduce from recorded observations some general laws in regard to relations that may or may not exist between sun-spots, magnetism, and other terrestrial phenomena. Their work and revelations on such matters are of the highest value, but not one of these scientists would presume to say that our present knowledge on the matters mentioned is of any practical value whatever in regard to any accurate forecasting of weather. Indeed, their object is really more the independent investigation of Nature's laws, without special regard to their use in forecasting. With respect to the question of heat received from the moon, A. B. M. gives a sentence which might be understood as a quotation from my article, but he does not give my words. I did not say "that weather changes are exclusively an effect of heat," neither did I say "that the moon has nothing to do with weather changes," but that I considered that lunar influence had not been definitely traced. And as regards the moon giving no sensible heat, if I am not mistaken the Earl of Rosse is one of those who have made and published observations thereon.

The outcome of the whole matter is, that whilst many minds are discussing many meteorological questions, nothing has yet been discovered that in any degree helps the forecasting of weather for long periods in advance. It is still only possible to do so for one or two days in advance, not from theoretical considerations, but simply from knowledge of the existing conditions of weather daily telegraphed from a great extent of country to the meteorological establishments of different nations. And there I leave the matter, desiring no prolonged discussion thereof. WILLIAM ELLIS.

Blackheath, May 7, 1904.

[Proofs of the two letters criticising Mr. Ellis were forwarded to him, and his reply is given above. Each writer is responsible for his own statements, which are printed in exact accordance with the proofs received from them. The correspondence confirms our feeling of gratitude to Mr. Ellis for expressing the outcome of his long experience and profound study of both meteorology and astronomy. The warning will not, we believe, fail to be of service to less experienced students. We will gladly welcome new light on any meteorological problem from any source, provided that the reasoning which conveys it is intelligible to us, and that the claimant to discoveries is willing to work out fully some portion of his chain of argument, and is not content merely to throw out fragmentary suggestions.—Ed. *S.M.M.*].

THE REMARKABLE DARKNESS OF APRIL 15th.

You probably have had information already of the phenomenal darkness of last Friday, 12.25 p.m., but I should be glad to know if there is any explanation as I never saw anything quite like it, yet I see no notice of it in the press.

(1.) It came from S.W. quickly, and therefore was not smoke cloud.

(2.) It resembled, while passing over, a tunnel (of darkness) with light visible at either end, and lasted 10 minutes.

(3.) It was not accompanied by thunder or rain, but with puffs of wind from S.W.

It was too dark to go on with garden work, even in the open, for 10 minutes.

Do you think the darkness was from snow clouds?

STANLEY SINGLE.

Park View, Leopold Road, Wimbledon,
April 18th, 1904.

PARASELENE.

At 10 p.m. on the 20th April a white lunar cross was visible here, like the inner cross shown in *Meteorological Magazine*, 1895, p. 123. The upper arm or pillar was about five lunar diameters in length, the side arms were three diameters, and the lower arm two diameters in length. At 10.30 only the upper arm was visible, much reduced in length and very slightly irridescent; shortly afterwards the moon disappeared behind a cloud. The time of moonset was 11.49 p.m.

Possibly, before I saw it the halo may have been more perfect.

J. P. MACLEAR.

Chiddingfold, Surrey.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, April 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

Mr. G. B. Clough, Mr. H. N. ffarrington, Mr. I. Goetz and Mr. A. E. Heyer were elected Fellows of the Society.

A paper by Mr. J. B. Cohen on "The Cause of Autumn Mists," was, in the absence of the author, read by Dr. W. N. Shaw. The author described some experiments which he had carried out on Coniston Lake in September, 1900. Two minimum thermometers were attached horizontally to the top and bottom of a stout board, which was floated on the water. The experiment was made about midnight, when a heavy mist hung over the water, and the thermometers were floated half-way across, and about half a mile from the head of, the lake. The depth of water was 22 feet, and the bottom temperature 57°·2. By this arrangement of thermometers, the temperature of the surface water and of the air in contact with it was taken simultaneously. It is clear that if any cooling of the surface water occurred, the cooler water would at once sink. The following are the results of two experiments:—

Experiment 1	Air	48°·2	Water	60°·8	Difference 12°·6
,, 2	,,	46·4	,,	60·8	,, 14·4

The point which appears to have escaped attention is that the phenomenon of autumn mist is accompanied by a difference of temperature of the air, which is warmer in the upper region of the atmosphere than at lower levels. The following temperatures were taken at different heights before sunrise on September 15th and 16th, 1900. The thermometers were suspended about 3 feet from the ground without any screen.

Lake Level.....		Sept. 15...47°·3	Sept. 16...46°·4	
Slope of Coniston Old Man...	1750 ft.	,, 51·8	,, 49·6	
Summit of Coniston Old Man	2600 ft.	,, 52·7	,, 50·9	

Thus, there was a difference in the one case of 5°·4, and in the other of 4°·5, between the lake level and the summit. All the lower ground as far as the horizon lay immersed in a perfectly level sea of purple mist, through which the peaks of the higher hills projected, forming, as it seemed, little scattered islands which were quite clear and sharply defined. Moreover, there was scarcely any dew either on the grass or stones on the summit, whereas it lay very thick everywhere at the level of the lake.

The explanation which seems to follow from the above observations is, that after sunset in still weather the higher ground as it passes into shade begins to cool by radiation, and to cool the air in *contact with it*, which becomes denser and flows down to a lower

level. The cold air on coming into contact with the warm moist air above the lake and surrounding ground, cools the latter below the dew-point and produces mist. The densest mist will naturally be found above damp ground or over water, which is precisely what occurs. Not only so, but if the sheet of water is long and narrow, with hills sloping down on both sides, as at Coniston, a thin column of mist will form where the stream of mist from both hillsides meets in the middle. This phenomenon is easily observed on Coniston lake by any one sitting in a boat an hour or two after sundown. At the same time a steady stream of mist may be seen flowing towards the lake from the adjacent meadows.

As the process continues, the whole basin of the valley fills with mist, which will go on rising until only the hill-tops remain visible, giving rise to the effect seen from the summit, and already described. After the sun has risen the mist clears, and the ground is found to be covered with a heavy dew. The dew is, however, not true dew in the sense that it is not produced by the deposition of moisture rising out of the ground and condensed by contact with a cold surface ; but is formed by the deposition of drops of water suspended as mist in the air. That this is the case was easily shown by mooring a tin dish containing a freshly cut sod free from dew some distance from the shore of the lake whilst mist was forming. As the mist probably prevents radiation from the grass blades of the sod, the sod must rather gain than lose heat by contact with the water surrounding the dish, which is warmer than the air. Yet, before sunrise the following morning, the blades of grass in the dish were covered just as plentifully with dew as the grass of the surrounding meadows. If this occurs on the water, it is more than probable that a similar process takes place on the surrounding land.

An interesting discussion followed the reading of this paper, in which the President, Dr. W. N. Shaw, Dr. H. R. Mill, Mr. F. Campbell Bayard, Mr. R. G. K. Lempfert, Mr. W. Marriott, Mr. H. Southall, Mr. Baldwin Latham, Mr. J. E. Clark, and Mr. J. Hopkinson took part.

The second paper was by Mr. W. L. Dallas, on "The Variation of the Population of India compared with the Variation of Rainfall in the decennium 1891–1901." The author showed that during the 4 years 1891-5, the rainfall was generally normal or heavy over nearly the whole of India, and during the 6 years 1895–1901 the rainfall was greatly deficient. During the former or "wet" period the rainfall was deficient over Upper Burma and Madras, was normal over the remainder of Burma, Assam, Bengal, and the West coast of the Peninsula, and was excessive elsewhere ; while during the latter or "dry" period the rainfall was again deficient over Upper Burma, normal or excessive over the remainder of Burma, Assam, Bengal, the United Provinces, the North-West Frontier Province, and the South of Madras, and was deficient elsewhere—most so over Rajputana and neighbouring areas.

The general Census of India taken on March 1st, 1901, showed the total population to be 293,475,477, which, excluding the territories not included in the Census of 1891, was an increase of only 1·3 per cent. The population has thus failed to increase according to the normal rate during the decade. Part of this failure was no doubt due to epidemics. The author, however, shows that there is an unmistakable relationship between the variations of the population and the variations of rainfall during the 6 dry years. The area within which the most serious decrease of population occurred coincides almost exactly with the area of greatest deficiency of rainfall.

The discussion of this paper was postponed until the next meeting of the Society.

REVIEWS.

Report of the Meteorological Council for the year ending 31*st of March*, 1903, *to the President and Council of the Royal Society. Presented to both Houses of Parliament by Command of His Majesty.* London: Eyre and Spottiswoode, 1904. Size 9½ × 6. Pp. 180. Price 11d.

One instinctively looks forward to the publication of the annual report presented by the Meteorological Council to the body by which it is elected and to which it is responsible. Though a long time elapses before the King is able to command its presentation to both Houses of Parliament, by one of which the money for carrying on the work is voted, the taxpayer, who ultimately pays for it all, at length is privileged to purchase for less than a shilling this record of the transactions concluded rather more than a year before. The Report has a long way to travel, and must obtain the approval of many august bodies and personages before it reaches the public, yet though it speaks of events of last year in the future tense, it retains a certain amount of freshness, and presents several features of interest to meteorological observers. The interest would have been far greater if the Report could have appeared earlier.

Amongst the points referred to in the Report are the incorporation of the climatological stations reporting to the Registrar-General with the general climatological organization of the Meteorological Office, and the increased correspondence with the meteorological departments of the Colonies.

We learn that Mr. P. Y. Alexander, of Bath, had offered to lend a balloon for experiments at the National Physical Laboratory on the temperature of the free air up to 1000 feet on calm days, but unfortunately when it was tried the weather was only approximately calm, and the balloon becoming free proceeded to the north coast of France and was recovered in a somewhat damaged condition.

We regret to see that the efforts to arrange for wireless telegraphic reports of pressure from Atlantic steamers through Lloyd's signal stations were fruitless, but we gather that this was in no way the *fault of the* Council.

During the year reported on the staff of the Meteorological Office was strengthened by the appointment of Mr. R. G. K. Lempfert, of Emmanuel College, Cambridge, as special scientific assistant to the Secretary. But it has suffered a loss through the retirement of Mr. Frederic Gaster, who had been in charge of the Forecast and Storm Warning Branch since 1868. Everyone who has had the privilege of knowing Mr. Gaster will cordially concur in the praise which the Council bestows on him after his long service.

The completely successful forecasts made at 8.30 p.m. amounted to 53 per cent., the partially successful to 35 per cent., the partial failures to 10 per cent., and the complete failures only to 2 per cent. This result for 1902 was better than for any of the last ten years. Of the storm warnings only 6 per cent. failed to be justified by the subsequent weather.

A History of the Daubeny Laboratory, Magdalen College, Oxford . . . by R. T. GÜNTHER, M.A., F.Z.S. London: Henry Fronde, 1904. Size 9 × 5½. Pp. viii.+138. Price 5s. net.

IN 1848 Dr. C. G. B. Daubeny, Professor of Chemistry, Botany and Rural Economy in the University of Oxford, built a laboratory and class-room adjoining the Physic Garden at Oxford on ground belonging to Magdalen College. The double professor (he had resigned the chair of Chemistry in 1854) died in 1867, and left all his collections to Magdalen College, together with a sum of money to provide the salary of a curator. In 1869, Mr. Edward Chapman, now M.P. for the Hyde Division of Cheshire, was appointed Lecturer on Natural Science, a position which he held until 1894, and he has been succeeded by the author of this interesting little history.

Meteorological records were started by Dr. Daubeny in 1861, but they were made by himself wherever he happened to be, at home or abroad, so that so far as Oxford is concerned the record is a broken one, and the fact that the observations lapsed at his death is of little importance. In 1868 they were resumed in a more systematic way, and in 1869 they came under the charge of Mr. Chapman, and have since been maintained in a state of efficiency. The shade thermometers, however, are not exposed in a standard screen, but placed against a north wall, and since 1873 observations have been made at 10 a.m. instead of the standard hour of 9 a.m. This makes it impossible to compare the results with other stations. There are two rain gauges, one at the standard height of 1 foot above ground and 190 feet above sea-level, the other on a roof 20 feet higher. There are also two river gauges in the Cherwell, and the temperature of the water in the river is recorded each morning. The observations on river temperature proved most useful when a Committee of the British Association was engaged on an investigation on the temperature of exposed water surfaces about twelve years ago. The monthly means for each year since 1882 are published in this volume,

and we reprint the summary table comparing the data for two nearly equal periods. It will be noticed that the difference between the water and air temperature remains practically the same, but that the mean rainfall of the second period is more than 2 inches less, and the mean temperature of both water and air one degree higher than in the first period. In the table the figure I. refers to the means for the ten years 1882–91, the figure II. to the means for the twelve years 1892–1903.

Mean Temperature of River Cherwell at Oxford.

Month.	Mean Air Temperature for Day.		Mean River Temperature, 10 a.m.		Excess of River over Air Temperature.		Average Rainfall in inches.	
	I.	II.	I.	II.	I.	II.	I.	II.
January	37°6	38°4	37°8	38°4	0°2	0°0	1·87	1·49
February ...	38·6	39·2	39·5	39·3	0·9	0·1	1·66	1·48
March.....	40·6	42·5	41·9	43·2	1·3	0·7	1·48	1·27
April	45·9	48·5	48·3	50·7	2·4	2·2	1·80	1·37
May.....	53·1	53·8	55·4	56·9	2·3	3·1	2·05	1·35
June	59·6	60·5	61·6	63 2	2·0	2·7	2·17	1·95
July	62·3	64·2	64·6	65·7	2·3	1·5	2·58	2·33
August	61·3	62·6	63·1	63·8	1·8	1·2	2·00	2·48
September ...	57·2	57·5	58·8	59·7	1·6	2·2	2·16	1·78
October	48·9	49·7	50·0	50·9	1·1	1·2	2·73	2·83
November ...	43·1	44·3	43·4	44 3	0·3	0·0	2·47	2·11
December ..	37·4	39·7	38·4	39·7	1·0	0·2	1·97	1·98
Year	48·9	50·0	50·3	51·3	1·4	1·3	24·94	22·42

Geographen-Kalender. In Verbinding mit Dr. Wilhelm Blankenberg, Professor Paul Langhans, Professor Paul Lehmann und Hugo Wichmann, herausgegeben von Dr. Hermann Haack. Zweiter Jahrgang: 1904-1905. Gotha, Justus Perthes. Size $6\frac{1}{2} \times 4$. Pp. 360. Portrait and Map. Price 4s.

This publication, now in its second year, claims to be a geographical "Who's Who?" and, as Geography is taken in its widest sense, it includes Meteorology. The previous issue gave a directory of about 5000 persons interested in the geographical sciences in all parts of the world, including the authors of all papers on meteorology who could be traced; the current issue gives a list of about 3000 institutions and societies and 2000 periodicals of similar aims. Although mainly in German, all the statistical tables are printed also in English and with the units familiar in English-speaking countries. There is no other work covering the same ground, and it should prove useful to meteorologists. The little book is very neatly got up and contains an engraved portrait of Sir Clements Markham.

THE DITTMAR RECORDING PEN.

AT the request of Mr. William Dittmar we have recently made a trial of a new form of pen for use with recording instruments, which he has patented. The particular pen was specially adapted for use on the Redier Barograph, but in principle it differs in no way from the ordinary form, as shown in the accompanying sketch. The pen may be used for any sort of recording instrument, and is particularly useful where absence of friction is a desideratum, as it works without any pressure on the paper.

The pen consists of a tiny cup to hold the ink, and an excessively fine capillary tube dipping nearly to the bottom, and drawn out to a point projecting at right angles from the side of the cup. When the cup is filled with ink the capillary tube may be filled by slight suction by means of an ordinary fountain-pen filler, and once filled it holds the ink, allowing it neither to run back into the cup nor to form a drop at the point. The maker claims the following among other advantages:—The pen records, in any direction, a line of equal breadth; a record can be taken at any desired speed; the ink only flows when the pen moves across the paper; the pen requires no attention when once started. We have found that the claim is fully justified, the line drawn being particularly fine, clear, and of uniform blackness. Observers who have been troubled by the unsightly dripping from some of the unsatisfactory types of recording pen will appreciate Mr. Dittmar's invention.

METEOROLOGICAL NEWS AND NOTES.

THE ROTHESAY METEOROLOGICAL RECORDS are amongst the oldest in the United Kingdom, and it is with regret that we read in the *Buteman* of April 23rd of their "threatened abandonment." We cannot believe that the historic interest in meteorology has so completely departed from Scotland as to permit such a suggestion to be carried out. Mr. Kay has performed a splendid service by keeping the record for 28 years, and deserves the greatest credit for his scientific zeal and public spirit. Now, when he finds it necessary to retire, we trust that some of his townsmen, or the Corporation itself, will see to the continuity of this record of 104 years.

BRITISH RAINFALL 1903, is now so far advanced that additional returns should be forwarded to the Editor within a week if they are to be utilized in the discussions. Amongst the returns received, there is one giving only the total of 43·60 in., but no other information; neither place nor name of observer, nor a word of handwriting, the envelope having a printed address. To complete the puzzle, the Post Office, which has done much to hamper the collection of rainfall statistics, succeeded in impressing a post-mark of which no single letter was legible! Did any of our readers record such a rainfall?

RAINFALL AND TEMPERATURE, APRIL, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	1·01	— ·51	·37	22	10	67·9	14	36·2	11	0	7
II.	Tenterden ...	1·22	— ·55	·37	12	10	66·0	14	33·0	22, 26	0	7
,,	Hartley Wintney ...	1·36	— ·28	·40	15	14	67·0	19	33·0	26	0	6
III.	Hitchin ...	·81	— ·71	·24	22	10	64·0	14, 18	35·0	17	0	...
,,	Winslow (Addington) ...	1·05	— ·51	·28	15, 22	12	65·0	14	33·0	11	0	10
IV.	Bury St. Edmunds (Westley)	·87	— ·66	·28	12	9	64·5	18	31·5	22	...	...
,,	Brundall ...	·86	— ·65	·37	22	11	68·6	15	32·8	22	0	4
V.	Alderbury ...	1·08	— ·69	·17	2	13	58·0	16*a*	32·0	1, 6	2	...
,,	Winterborne Steepleton ...	1·35	...	·35	15	12	64·0	20	32·0	11	1	6
,,	Torquay (Cary Green) ...	1·09	...	·37	13	12	63·3	24	37·6	17	0	6
,,	Polapit Tamar [Launceston]	1·99	— ·17	·54	13	18	61·3	19	31·0	26	2	2
,,	Bath ...	1·80	...	·32	22	14	63·2	18	33·8	17	0	...
VI.	Stroud (Upfield) ...	1·23	— ·61	·21	15	15	63·0	18, 30	37·0	10	0	...
,,	Church Stretton (Woolstaston)	1·64	— ·24	·35	22	16	63·5	24	...	...	...	...
,,	Bromsgrove (Stoke Reformatory)	1·24	— ·11	·26	14	10	61·0	18	..	...	...	...
VII.	Boston ...	·74	— ·64	·25	22	10	65·0	14	34·0	22	...	...
,,	Bawtry (Hesley Hall) ...	1·07	— ·27	·27	15	13	...	...	...	...	...	...
,,	Derby (Midland Railway)...	1·67	+ ·12	·49	14	16	65·0	19, 20	34·0	15	0	...
VIII.	Bolton (The Park) ...	2·57	+ ·38	·31	2	21	59·5	19	35·6	10	0	1
IX.	Wetherby (Ribston Hall) ...	1·78	+ ·04	·39	14	16	...	...	...	...	..	...
,,	Arncliffe Vicarage ...	7·68	+ 4·32	1·31	28	21	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	1·15	— ·44	·40	15	14	63·0	29, 30	34·0	12*b*	0	7
X.	Newcastle (Town Moor) ...	1·59	— ·07	·37	22	14	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	14·40	+ 8·06	2·60	2	21	63·5	19	33·6	1	0	...
XI.	Cardiff (Ely) ...	2·28	+ ·10	·35	2, 29	17	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	2·12	— ·30	·41	13	14	63·7	19	33·7	11	0	3
,,	Aberystwith (Gogerddan)..	3·08	+ ·51	·72	29	13	70·0	19	34·0	19	0	...
,,	Llandudno ...	1·49	— ·29	·18	2	17	62·0	12	38·8	9	0	...
XII.	Cargen [Dumfries] ...	4·38	+ 2·05	·86	3	19	64·0	19	34 0	12	0	...
XIII.	Edinburgh (Royal Observy.)	1·69	...	·30	9	17	62·5	19	32·6	10	0	5
XIV.	Colmonell ...	2·71	+ ·54	·48	28	20	64·0	29	31·0	26	1	...
XV.	Tighnabruaich ...	6·67	...	·77	2	27	54·0	23	31·0	20	3	3
,,	Mull (Quinish) ...	6·17	+ 3·38	·89	5	27	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	4·23	+ 2·24	·60	3	16	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	1·70	+ ·16	·30	5, 13	18	63·6	18	33·6	9, 19	0	...
XVII.	Braemar ...	2·78	+ ·69	·70	2	18	56·3	19	23·3	1	5	23
,,	Aberdeen (Cranford) ...	1·83	— ·01	·51	13	16	61·0	29	30 0	3, 4	4	...
,,	Cawdor (Budgate) ...	2·77	+ 1·20	·58	6	19	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	13·29	+ 8·63	1·30	27	27	...	...	...	...	..	...
,,	Bendamph. ...	12 15	+ 7·75	1·50	2	25	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	5·25	+ 3·48	·80	27	19	60·0	19	30·0	4	1	...
,,	Castletown ...	4·17	...	·76	5	25	63·0	19	31·0	8, 9	5	...
XX.	Killarney ...	3·23	— ·53	·58	3	22	64·0	30	37·0	1	0	...
,,	Waterford (Brook Lodge)...	1·15	— 1·47	·21	17	14	61·5	19, 29	29·0	11	1	...
,,	Broadford (Hurdlestown) ...	2·09	+ ·01	·28	17	23	60·0	29	34·0	16*c*	0	...
XXI.	Carlow (Browne's Hill) ...	1·54	— ·75	·37	2	12	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·12	— ·85	·19	2	19	62·0	27	35·7	21	0	1
XXII.	Ballinasloe ...	2·08	— ·21	·29	2	23	67·0	19	29·0	19	3	...
,,	Clifden (Kylemore House)..	7·39	+ 2·12	1·00	13	25	...	...	...	...	...	...
XXIII.	Seaforde ...	2·49	+ ·06	·25	2	23	60·0	18	32·0	18	1	3
,,	Londonderry (Creggan Res.)	3·22	+ ·76	·30	9	26	...	...	...	...	...	...
,,	/ *Omagh (Edenfel)* ...	3·07	+ ·71	·60	5	24	60·0	19	32·0	9*c*	3	7

Shows that the fall was above the average; — that it was below it. *a* and 18, 19, 20. *b* and 16, 20, 21. *c* and 17, 2

SUPPLEMENTARY RAINFALL, APRIL, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·36	XI.	New Radnor, Ednol	2·13
,,	Sheppey, Leysdown	·90	,,	Rhayader, Nantgwillt	4·18
,,	Hailsham	1·08	,,	Lake Vyrnwy	4·22
,,	Crowborough	1·43	,,	Ruthin, Plâs Dràw	1·14
,,	Ryde, Beldornie Tower	1·03	,,	Criccieth, Talarvor	2·52
,,	Emsworth, Redlands	1·31	,,	Anglesey, Lligwy	2·19
,,	Alton, Ashdell	1·70	,,	Douglas, Woodville	2·20
,,	Newbury, Welford Park	1·35	XII.	Stoneykirk, Ardwell House	1·69
III.	Harrow Weald	·95	,,	Dalry, Old Garroch	6·02
,,	Oxford, Magdalen College	·77	,,	Langholm, Drove Road	5·74
,,	Banbury, Bloxham	·89	,,	Moniaive, Maxwelton House	4·81
,,	Pitsford, Sedgebrook	·88	,,	Lilliesleaf, Riddell	2·36
,,	Huntingdon, Brampton	·71	XIII.	N. Esk Reservoir [Penicuick]	4·30
,,	Wisbech, Bank House	·52	XIV.	Maybole, Knockdon Farm	3·54
IV.	Southend	·58	,,	Glasgow, Queen's Park	4·39
,,	Colchester, Lexden	·92	XV.	Inveraray, Newtown	9·69
,,	Saffron Waldon, Newport	·83	,,	Ballachulish, Ardsheal	11·66
,,	Rendlesham Hall	·99	,,	Campbeltown, Redknowe	3·62
,,	Swaffham	1·12	,,	Islay, Eallabus	5·29
,,	Blakeney	·58	XVI.	Dollar	5·02
V.	Bishop's Cannings	1·52	,,	Balquhidder, Stronvar	9·79
,,	Ashburton, Druid House	2·21	,,	Coupar Angus Station	2·27
,,	Okehampton, Oaklands	2·62	,,	Blair Atholl	4·01
,,	Hartland Abbey	1·75	,,	Montrose, Sunnyside	1·32
,,	Lynmouth, Rock House	1·70	XVII.	Alford, Lynturk Manse	1·97
,,	Probus, Lamellyn	1·32	,,	Keith, H.R.S.	2·09
,,	Wellington, The Avenue	1·21	XVIII.	Fearn, Lower Pitkerrie	2·33
,,	North Cadbury Rectory	1·45	,,	S. Uist, Askernish	5·58
VI.	Clifton, Pembroke Road	2·29	,,	Invergarry	11·44
,,	Moreton-in-Marsh, Longboro'	1·21	,,	Aviemore, Alvie Manse	2·96
,,	Ross, The Graig	1·25	,,	Loch Ness, Drumnadrochit	4·15
,,	Shifnal, Hatton Grange	1·35	XIX.	Invershin	4·44
,,	Wem Rectory	·87	,,	Altnaharra	6·67
,,	Cheadle, The Heath House	1·92	,,	Bettyhill	5·03
,,	Coventry, Kingswood	1·15	,,	Watten, H.R.S.	3·19
VII.	Market Overton	1·28	XX.	Cork, Wellesley Terrace	1·28
,,	Market Rasen	·99	,,	Darrynane Abbey	3·23
,,	Worksop, Hodsock Priory	1·18	,,	Glenam [Clonmel]	2·16
VIII.	Neston, Hinderton	·73	,,	Ballingarry, Hazelfort	1·95
,,	Southport, Hesketh Park	1·69	,,	Miltown Malbay	3·79
,,	Chatburn, Middlewood	4·21	XXI.	Gorey, Courtown House	1·22
,,	Duddon Valley, Seathwaite Vic.	6·02	,,	Moynalty, Westland	1·88
IX.	Langsett Moor, Up. Midhope	3·68	,,	Athlone, Twyford	2·17
,,	Baldersby	1·56	,,	Mullingar, Belvedere	2·19
,,	Scalby, Silverdale	1·27	XXII.	Woodlawn	2·10
,,	Ingleby Greenhow Vicarage	1·78	,,	Westport, Murrisk Abbey	4·24
,,	Middleton, Mickleton	2·02	,,	Crossmolina, Enniscoe	5·33
X.	Beltingham	2·88	,,	Collooney, Markree Obsy	3·49
,,	Bamburgh	·78	XXIII.	Enniskillen, Portora	2·95
,,	Keswick, The Bank	5·13	,,	Warrenpoint	2·19
,,	Melmerby Rectory	2·63	,,	Banbridge, Milltown	1·70
XI.	Llanfrechfa Grange	2·01	,,	Belfast, Springfield	3·20
,,	Treherbert, Tyn-y-waun	6·63	,,	Bushmills, Dundarave	2·77
,,	Llandovery, Tonn	2·45	,,	Stewartstown	2·65
,,	Castle Malgwyn	2·56	,,	Killybegs	3·41
,,	Llandefaelog-fach	2·02	,,	Horn Head	3·38

METEOROLOGICAL NOTES ON APRIL, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A month of beautiful weather, mild and sunny, with cool breezes but almost entire absence of harsh E. wind. The R was slight and the greater part fell during the night. No frost was registered in the screen, and the mean min. temp. was 43°·4, or 3°·7 above the average, and the highest in April during 47 years. The duration of sunshine was 141·3* hours and of R only 18·9 hours. Mean temp. 48°·1, or 2°·4 above the average.

TENTERDEN.—A beautiful spring month, generally dry, but very windy for the first 10 days. Duration of sunshine 177† hours.

HARTLEY WINTNEY.—Showery, with westerly winds for the first fortnight; then drier and harsher. Vegetation backward.

PITSFORD, SEDGEBROOK.—The first week was rather wet and squally, the remainder fine and warm. R ·96 in. below the average. Mean temp. 48°·5.

BRUNDALL.—A magnificent April, warmer than any since 1894. On no day did the temp. fail to reach 50°, an occurrence which has not happened since observations commenced in 1883.

TORQUAY.—R 1·28 in. below the average. Duration of sunshine 180·2* hours, or equal to the average. Mean temp. 50°·2, or 2°·0 above the average. Mean amount of ozone 5·8.

WELLINGTON.—On the 15th set in one of the finest periods experienced for a considerable time, only ·08 in. of R falling on 16 days. Abundant sunshine.

NORTH CADBURY RECTORY.—Seasonable, with small range of temp. R less than in any April in 8 years, and less than in any month since Sept., 1902.

CLIFTON.—The first fortnight was showery and cool, with rather strong westerly winds. Fine weather from 16th to 20th and from 23rd to 27th.

ROSS.—An almost typical April, with much less R than usual. The mean min. (41°·8) was the highest since 1865, but the max. (57°·4) was scarcely above the average. On no night was frost recorded in the screen, and as a consequence vegetation, though somewhat backward, progressed rapidly.

BOLTON.—Typical April weather, showers and sunshine being sandwiched together throughout. The shade min. (35°·6) was the highest on record, and the daily range (10°·7) the least in 18 years. Mean temp. 45°·5, or 1°·2 above the average. Duration of sunshine 102·7* hours, or 8 hours below the average.

SOUTHPORT.—Exceptionally stormy, W.S.W. winds greatly preponderating. Mean temp. 1°·3 above the average. Duration of sunshine 7* hours below the average, and R ·03 in. below the average. Mean daily movement of the wind 135 miles above the average.

UPPER MIDHOPE.—Stormy from 1st to 10th, with sleet, S, H and R. Fine from 16th to 30th. R ·82 in. above the average of 9 years.

HULL.—On the whole genial spring weather prevailed. After the 7th it was generally mild, with a fair amount of bright sunshine.

LLANFRECHFA GRANGE.—Cold winds and warm sun in the latter part; favourable for garden and field work.

HAVERFORDWEST.—Strong westerly winds and gales throughout. No extremes of temp., which was uniformly below the average, especially the max.; this exercised a salutary influence in checking blossom of fruit trees and vegetation generally. Duration of sunshine 147·6* hours.

DOUGLAS.—The gale of March 31st continued without intermission until April 11th. Temp. about normal, with low maxima. The light R and constant wind were favourable to agriculture.

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* Campbell-Stokes. † Jordan.

SCOTLAND.

MAXWELTON HOUSE.—The first half was wet and cold, the second fine and warm with much sunshine. Mean temp. 46°·0, or 1°·0 above the average. R 2·04 in. above the average.

LILLIESLEAF, RIDDELL.—Very windy throughout, and cold up to the last few days. Vegetation was backward, but seeds well got in.

BALLACHULISH.—R 7·25 in. above the average and the greatest recorded here.

MULL, QUINISH.—The wettest April since the gauge was started in 1874.

LYNTURK MANSE.—Frequent strong winds throughout. Notwithstanding a large number of rainy days, there was a good sowing time.

DRUMNADROCHIT.—The greatest R in April for 19 years, and 2·38 in. above the average. The rainy days were also the greatest on record.

BETTYHILL.—Heavy R, generally accompanied by strong winds.

CASTLETOWN.—The first half was cold, windy and wet, with S on 9th. From 15th to 21st was very mild and dry, and from 21st to the end wet, stormy and cold.

IRELAND.

CORK.—R 1·60 in. less than the average. Mean temp. 3°·5 below the average.

DARRYNANE ABBEY.—Changeable, with strong northerly wind. R 13 per cent. below the average. Vegetation very backward.

WATERFORD.—R less than half the average. A very late spring.

MILTOWN MALBAY.—The stormiest and coldest April remembered. Only four days without R.

DUBLIN.—Favourable though changeable. The first few days were stormy and cold, but after the 9th only ·29 in. of R fell. Mean temp. 49°·1 and duration of sunshine 175·5 hours, both above the average. R was frequent, but moderate in amount.

OMAGH, EDENFEL.—Harsh and unsettled, except for a short spell in the middle. The weather was such as might be expected from the frequent fluctuating pressure. Although robust vegetation did not suffer much, delicate garden seeds made little progress.

THE FOUR MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—April, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	7·64	124	Arncliffe	25·13	128	Braemar	9·22	94
Tenterden	9·34	131	Hull	6·61	100	Aberdeen	11·16	122
Hartley Wintney	9·35	138	Newcastle.....	7·33	107	Cawdor	7·30	92
Hitchin	7·18	117	Seathwaite ...	52·94	121	Glencarron ...	31·35	107
Winslow	8·41	135	Cardiff	16·59	148	Dunrobin	11·74	127
Westley	6·95	109	Haverfordwest	16·22	124	Killarney ...	21·04	125
Brundall.....	7·47	118	Gogerddan ...	14·58	114	Waterford ...	16·12	139
Alderbury	11·46	143	Llandudno ...	9·28	113	Broadford.. ...	13·39	139
Ashburton	24·19	146	Dumfries	14·77	108	Carlow	11·59	115
Polapit Tamar ...	17·91	173	Lilliesleaf	10·63	124	Dublin	9·06	115
Stroud	10·97	143	Colmonell	13·91	102	Mullingar.....	14·25	137
Woolstaston	10·42	128	Glasgow	12·28	117	Ballinasloe ...	14·16	134
Boston	6·09	115	Inveraray	26·43	113	Clifden	31·12	128
Hesley Hall	7·31	131	Islay	18·26	131	Crossmolina ...	23·14	140
Derby.....	8·09	134	Mull	22·72	129	Seaforde	12·29	111
Bolton	12·40	119	Loch Leven ...	11·99	113	Londonderry..	13·34	116
Wetherby	9·52	147	Dundee	9·55	117	Omagh	16·10	146

NOTE.—In the above Table the first column gives the total rainfall of the four months, not, as in former years, the difference from the average.

Climatological Table for the British Empire, November, 1903.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	a-10m	°	°	inches		
London, Camden Square	57·2	1	29·9	20	50·2	39·7	41·3	88	82·3	23·3	1·86	12	6·3
Malta	75·3	18	48·5	14	66·9	55·4	54·9	86	119·1	43·4	3·38	14	4·6
Lagos, W. Africa	91·0	22	70·0	10	87·4	75·1	75·2	75	146·0	68·0	4·11	7	4·9
Cape Town	86·0	9	46·1	16	70·2	53·3	51·1	68	...	...	·25	4	4·6
Durban, Natal	87·6	19	52·4	4	78·6	63·2	...	...	146·1	...	8·99	19	6·7
Mauritius	88·4	27*a*	60·1	23	82·7	65·1	61·5	66	152·3	54·5	·96	8	4·9
Calcutta	84·4	3	57·9	30	81·3	64·8	63·2	71	145·0	52·1	·02	1	3·2
Bombay	90·5	11	68·3	27	86·3	72·3	69·0	72	137·5	58·2	·00	0	1·5
Madras	89·8	1	66·0	25	82·9	72·2	71·2	85	141·3	60·5	17·76	13	6·3
Kodaikanal	69·8	23	45·7	21	62·8	50·4	47·0	76	132·8	34·3	5·85	12	5·7
Colombo, Ceylon	90·7	13	70·5	27	88·5	74·6	72·4	78	155·0	65·5	·94	12	4·9
Hongkong	85·3	18	46·7	28	73·8	62·1	53·6	62	133·3	...	1·09	3	4·0
Melbourne	93·9	25	41·9	13	72·2	53·6	51·3	68	156·1	34·0	4·28	10	6·2
Adelaide	96·2	25	46·3	13	80·2	58·5	49·8	49	149·7	40·4	2·57	12	4·6
Coolgardie	99·0	24	46·0	15*b*	82·7	55·6	47·6	47	162·6	43·1	·15	4	3·0
Sydney	95·1	26	51·4	21	71·6	58·9	57·0	68	132·3	44·2	1·96	13	6·2
Wellington	79·5	30	38·2	21	67·3	51·3	51·4	76	136·0	30·0	5·41	12	6·4
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Negril Point	89·2	7	61·0	30	85·4	71·1	70·3	77	...	...	2·46	9	...
Trinidad	91·0	Var	67·0	21	77·2	73·0	71·0	72	177·0	64·0	2·59	5	...
Grenada	88·6	28	72·2	1	85·5	74·9	72·6	77	152·0	...	2·55	13	2·5
Toronto	70·2	3	6·1	26	42·2	27·8	27·2	76	86·0	2·4	1·26	14	6·1
Fredericton	60·7	4	3·1	27	39·9	22·9	22·2	67	...	...	4·86	13	5·8
Winnipeg	71·3	2	−28·7	25	29·1	8·4	...	...	...	...	1·50	5	4·8
Victoria, B.C.	59·0	1	31·2	17	47·9	41·1	...	...	...	...	6·00	...	8·8
Dawson	40·5	4	−42·4	16	2·7	−10·3	...	...	...	...	·45	4	3·8

a and 30. *b* and 16.

MALTA.—Mean temp. of air 2°·6 below, dew point 0°·5 above, and R ·24 in. below, and mean hourly velocity of wind 0·8 miles above averages. Mean temp. of sea 67°·2.

Natal.—R 3·99 in. above 30 years' average.

Mauritius.—Mean temp. of air 1°·5, dew point 2°·4, and R ·90 in. below, averages. Mean hourly velocity of wind 10·4 miles, or 0·1 mile below average; extremes 23·5 on 15th, and 2·0 on 28th; mean direction E. by S.

MADRAS.—Bright sunshine 122·6 hours, or 35·6 per cent. of the possible amount.

KODAIKANAL.—Mean temp. of air 55°·0. Mean velocity of wind 237 miles per day. Bright sunshine 143·6 hours.

COLOMBO, CEYLON.—Mean temp. of air 81°·0 or 1°·2 above, of dew point 0°·1, and R 12·06 in., below averages. Mean hourly velocity of wind 8·2 miles, prevailing dir. S.W.

HONGKONG.—Mean temp. of air 67°·2, or 2°·0 below average. Bright sunshine 209·2 hours. Mean hourly velocity of wind 9·6 miles; prevailing direction N.E.

Adelaide.—Mean temp. of air 2°·1, and R 1·59 in., above averages.

Sydney.—Mean temp. of air 1°·6, humidity 1·0, and R 1·19 in., below averages.

Wellington.—Mean temp. of air 5°·1, and R 2·45 in., above averages.

TRINIDAD.—R 4·69 in. below the 40 years' average.

Symons's Meteorological Magazine.

No. 461. JUNE. Vol. XXXIX.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

A THREE YEARS' PERIOD IN RAINFALL.

I HAVE stumbled on a period in my own rainfall figures which may be only a coincidence, but it is so regular that I should like to know whether it would hold good for other parts. The period is a three year one, and goes back for the whole time of my observations, *viz.*, 24 years.

I.	1879...No record Very wet	1882...57·53	1885...49·81	1888...51·64
II.	1880...45·09	1883...48·60	1886...48·16	1889...40·59
III.	1881...48·04	1884...41·11	1887...30·44	1890.. 48·18
I.	1891...54·41	1894...51·16	1897...52·06	1900...53·84
II.	1892...37·43	1895...46·97	1898...38·41	1901...39·11
III.	1893...37·36	1896...37·77	1899...41·08	1902...39·72

I.	1903...58·76		I. 53·65
II.	1904... —	Means...	II. 43·04
III.	1905... —		III. 40·46

How I came upon this is interesting, though this too may be a coincidence. In accordance with my usual custom if I hear of any periodic terrestrial or cosmic phenomena, I try to see if I can find any relation to meteorological records. Thus, in *Nature* of the 17th ult., I found a report of a six years' period for the polar motion, the latest maximum deviations occurring in 1891 and 1897, whilst the minima were in 1894 and 1900. On referring to my table it will be seen that all these years are those of maximum rainfall, the rainfall period being thus half the length of the polar period.

I note that the sequence appears to begin in 1879, and in this connection the figures for Truro since 1850, which I have been examining since writing the above, may be of interest. They seem, in one way, to destroy the validity of the three years' period, and yet this is scarcely so, as may be seen from the rainfall chart issued by the Royal Institution of Cornwall. It shows that 1852 is a year

of maximum rainfall; 1855 is a year of minimum, which is the beginning of severe recurrences of minima in three years; then we have two periods not well marked, followed by seven (now eight) recurrences of maximum rainfall in three years. It looks rather, if such a thing were possible, as if there is something causing a reversal, and the period from 1874 to 1880 gives the appearance of being a transition period and under the influence of two opposing forces or conditions. It will be noticed, too, that from 1852 to 1877 is 25 years, and if this is the length of the cycle we should now be near another time of reversal. The year 1852, just before the change it may also be noticed, was a year of exceptional rainfall something like last year (1903). Again, the average yearly rainfall from 1855 to 1872, inclusive, is about three inches more than that for the years 1882 to 1902 inclusive.

Thus, in this neighbourhood, there has been, with two exceptions, a three years' period certainly from 1852 onward, but at about the middle of this period there was a reversal. This reversal idea may look like special pleading, but the regularity of the sequence in the two periods is certainly striking. The reversal peculiarity, too, would tend to mask the three year period if the observations ran over a long series of years.

ARTHUR P. JENKIN.

Trewirgie, Redruth, April, 1904.

[Mr. Jenkin has hit upon a very interesting recurrence which we have often noticed and frequently referred to as an example of an undoubted cycle springing up suddenly and therefore not to be depended on for the future. There is no doubt as to the recurrence of one wet and two less wet years in all parts of the British Isles during the last fifteen or sixteen years. Some stations do not show the relation clearly, but the general average of the whole country does so from 1891 onwards, as is shown in the Table on p. [154] of *British Rainfall, 1902*. The figures as percentage differences from the mean may be grouped as follows :—

1891 + 5	1894 + 5	1897 + 2	1900 + 11	Mean	I. + 6
1892 — 6	1895 — 8	1898 — 5	1901 — 10		II. — 7
1893 —15	1896 — 7	1899 — 2	1902 — 15		III. —10

The earlier years given in the Table just cited show no relation to the Cornish record or to the three-years' cycle, except in the means. They are :—

1882 +22	1885 — 3	1888 —6	Mean	I. + 4
1883 + 8	1886 + 7	1889 —8		II. + 2
1884 —11	1887 —28	1890 —4		III. —14

The subject is one of the many which we hope to investigate fully when time can be found. With reference to this repetition of one wet and two dry years, we wrote in *The Times* of 18th November, 1903, in the course of a controversy on Meteorological Cycles, as follows :—

"I could mention some curious and quite empirical recurrences of short period which have held good for the British Isles as a whole for many cycles, but which did not hold before a given date, and consequently cannot be expected to continue throughout the future. Should they hold good once more, 1904 and 1905 will prove dry."

There is some indication that Mr. Jenkin's suggestion of a reversal of the order of wet and dry years might carry a three years' cycle further back. It may be that in dry spells like 1891—1902 the order of one wet and two dry years holds, and in wet spells the order of one dry year and two wet. In the meantime, we shall gladly receive the opinions of our readers, and in the future we may discuss the problem in all its bearings.—ED. *S.M.M.*]

A DANGER IN "SMOOTHING" RAINFALL VALUES.

DEALING with 73 years of monthly rainfall at York (1831—1903), I had first smoothed to three-yearly means, before testing for any possible association with Wolfer's eleven-year sun-spot cycles, by taking the average of the 6½ cycles for each year, I. to XI., of the smoothed cycle, where I. is the year of minimum sun-spots and VI. of maximum. The examination dealt specially with the three autumn months, August to October. The method was fully justified when considering the cycle as a whole.

On re-working the results without first smoothing, however, I found that a striking peculiarity had been entirely obscured: namely, a sudden rise from the second to the third year of the cycle. In August and October this gives the highest point of the curve. This is the more striking in October as the minimum is in the previous year (II.) The same is the case for the whole year, based on 87 years in all, or nearly eight cycles. The actual means are: for October, 1·5 inches in II., 3·6 inches in III.; for the year, 23·0 inches in II., 27·7 inches in III. Thus III. compares with II. as 240 and 120 to 100, respectively. The means are 2·59 and 24·73 inches.

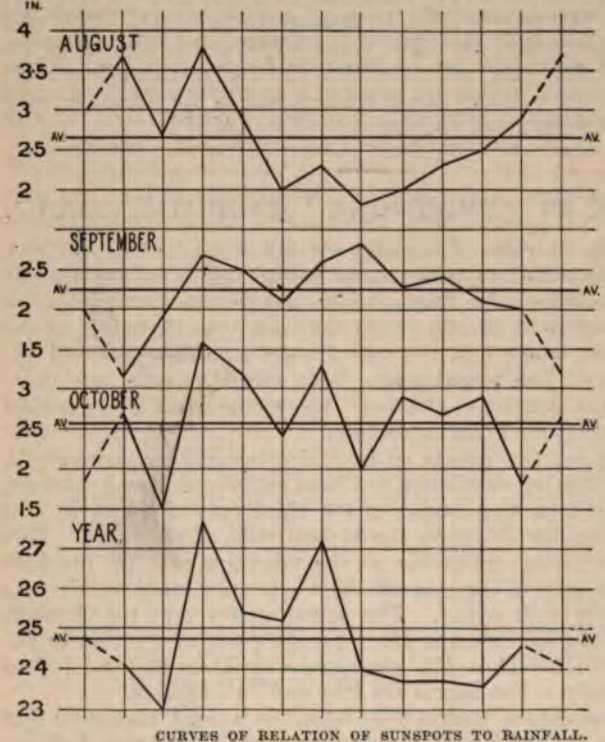
When the smoothed figures were used, the annual maximum was transferred to IV. and V. and the minimum to IX. As stated above, this, for general results, is important. It is instructive that we get a continuous, very regular curve, from 23·7 in. to 25·9 in.

In 1902 the York year's rainfall was 18·69 in. In 1903 it rose to 30·31 in. It is significant that these are, presumably, the years II. and III. of the current sun-spot cycle (*i.e.*, if the period from minimum to maximum proves normal).

Taking all 12 months and the whole year, the following further facts are of interest:—

(*a*). Six of the thirteen show an apex in the curve at III.; in three othere there is a considerable rise, but continued to IV. January, June and November are neutral. February gives the minimum in III.

	MIN.	II	III	IV	V	MAX.	VII	VIII	IX	X	XI	MEANS. INCHES.
AUG.	37	27	38	29	20	23	18	20	23	25	29	268 (70 Years)
SEPT.	12	19	27	25	21	26	28	23	24	21	20	226 („ „)
OCT.	27	15	36	32	24	33	20	29	27	29	18	259 („ „)
YEAR.	241	230	277	254	252	272	240	237	237	236	246	2473 (84 „)



CURVES OF RELATION OF SUNSPOTS TO RAINFALL.

(*b.*) Twenty of the twenty-six maxima and minima fall either on I. and VI. or on the two years following. Chance distribution would make us expect fourteen only.

(*c.*) No maximum or minimum occurs in XI.; only one in V.

(*d.*) In nearly every case of a marked break in the regularity of the curves this occurs in III.

(*e.*) Lockyer's curves from Tacchini's solar prominence values show precisely similar sudden rises from a minimum to a maximum in 1881 and 1892.

The object of the present note is that other records may be considered in the same way. The long series from Padua shows very *similar* peculiarities, though these are rather less marked when only *the last seventy years* are considered. J. EDMUND CLARK.

CLOUD OBSERVATIONS AND UPPER ATMOSPHERIC CURRENTS.

AETER numerous observations I have noticed repeatedly how thin rolled stratus bands, if watched for some time, will gradually break up into cirro-cumulus cloudlets of varying size; also, the large drifts of stratified cumulus will break up into alto-cumulus drifts. It would appear that warmer currents with an ascensional movement are setting in, in the upper atmosphere, to produce these disintegrations, and unsettled weather may as a rule be looked for to follow. These cloud formations and their gradual change were visible to the best advantage on January 17th last. The wind blew from the W. with the force of a light breeze and cloud movement was from the N.W. At 4 p.m. the sky from the W. to zenith was covered with thin roll stratus in the form of narrow pleats, which by 4.30 p.m. had completely broken up, giving place to a pallium of cirro-cumulus. At 9 a.m. on the same day the same changes were visible but on a larger scale, the thin roll stratus being replaced by strato-cumulus and the cirro-cumulus by alto-cumulus. Another peculiarity I have noticed is the relation of the wind, when blowing in eddies at the earth's surface, to the cloud formation above. To take an example: on February 4th last, at 5.30 p.m., after a fine day with a light S.W. breeze, straight tapering bands of cirro-macula and alto-stratus were visible in the S.W., parallel to the S.W. horizon; by 6 p.m. the wind, though variable in force at times, reached the force of a moderate breeze from the W. to S.W., coming in eddies with a whirling movement; the bands of cirro-macula and alto-stratus by this time had the appearance of being swept backwards and forwards and twisted up, as though under the influence of irregular currents with a whirling movement as were prevalent at the Earth's surface.

Lately specially strong currents appear to have been at work in the upper atmosphere when a light breeze has been blowing at the surface of the ground. On March 22nd last, during the evening, cumulo-nimbus was very prevalent with fair intervals. Cloud movement was from the N.W., the estimated motion being 2; when the cloud-bank had passed over zenith and was in the S.E. quarter, the bank had the peculiar appearance of being heaped upwards with a swept-up appearance, as though under the influence of strong currents with a sweeping upward movement.

On March 28th air currents were most diversified in force; at a height of 6 ft. from the ground in an open situation the wind blew with the force of a gentle breeze from the S.S.W.; higher up, at about 40 ft., among an avenue of elm trees, the wind reached the force of a strong breeze, their top branches swaying most rapidly; and lower down, though equally exposed, the movement was nil. A moderate gale sprang up from the S.W. towards 10 p.m. on the above date.

Sutton, Surrey. S. C. RUSSELL.

HISTORY OF THE DAUBENY LABORATORY.

In your recent review of "A History of the Daubeny Laboratory, Magdalen College, Oxford" (*Met. Mag.*, p. 73), the figures given for the average rainfall for the months of October, November and December, as well as for the averages for the year, are given correctly, but in certain copies of the book, which were sent out before the corrections were made, they have been wrongly stated. I am much obliged to you for having drawn my attention to an important clerical error.

R. T. GÜNTHER.

Magdalen College, Oxford, May 23rd, 1904.

HEAVY RAIN OF MAY 27th.

On Friday morning the rainfall registered ·33 of an inch, from 10.15 to 12.25 ·75 of an inch fell, at 7.30 p.m. 1·69 inches had fallen, and at 9 a.m. on Saturday morning there was ·04 of an inch, giving a total of 2·48 inches for the 24 hours. Very heavy thunder and lightning occurred about 12 o'clock overhead. This is a record for this station, being the highest ever registered for the previous 24 hours for the 10 years during which observations have been taken.

WILLIAM HALL.

Swerford, Oxford, 30th May, 1904.

ROYAL METEOROLOGICAL SOCIETY.

The first of the Afternoon Meetings for the present session was held on Wednesday, May 18th, in the Society's Rooms, 70, Victoria-street, Westminster, Captain D. Wilson-Barker, President, in the chair. Mr. W. M. Edwards, Mr. E. G. Fenning, Mr. K. H. M. ffinch, Mr. R. G. Kirkby, and Mr. L. G. H. Lee were elected Fellows of the Society.

Previous to the discussion on Mr. W. L. Dallas's paper on "The Variation of the Population of India compared with the Variation of Rainfall in the decennium 1891–1901," which had been postponed from the last meeting, Dr. H. R. Mill gave a brief summary of the contents of the paper. [See this *Magazine*, vol. **39**. p. 71.]

Dr. A. Buchan, F.R.S., and Mr. Baldwin Latham showed that Plague was influenced to a great extent by meteorological conditions, and that it followed the tensional difference between the temperature of the soil at a depth of 5 feet and the tensional difference due to the temperature of the dew point of the air, or that it arose from exhalations from a polluted and pest-sown soil.

Dr. H. R. Mill said that the paper had a special interest for him on account of the way in which it sought for a connection between

varying meteorological conditions and vital statistics. The problem was one of great geographical interest, and he believed that the relations pointed out by the author were not likely to be set aside. Dr. Mill then criticized Mr. Dallas's method of obtaining the mean rainfall for the various provinces, and said that it seemed to him that the only possible way of comparing the fluctuations of rainfall in such a case was by reducing all the values to percentages and allowing for the area of the division, or by weighting the means in proportion to the areas to which they referred so as to yield figures representative of the actual volume of precipitation.

The Hon. F. A. Rollo Russell read a paper on "The Principal Causes of Rain." He stated that the chief causes of rain are only four, but several of these are often in co-operation. These causes might be briefly described as follows :—(1.) The forced ascent of moist air by the slopes of mountains. (2.) A mass of air invading rather suddenly another mass moving from an opposite direction and maintaining its flow below the opposing current which it displaces. (3.) The ascent of more or less moist air through heavier and colder air to a height where condensation of vapour takes place, increased radiation of heat towards space, and often electrical developments producing further condensation, increase of temperature and renewed ascent with the same results. (4.) The mixture of currents of air from different directions.

A brief discussion followed, in which the President, Mr. D. W. Horner, Mr. H. Southall, and Mr. F. Gaster took part, and Mr. Russell replied.

Mr. W. C. Nash read a paper on "The Observations of Rainfall at the Royal Observatory, Greenwich, in the years 1815 to 1903." The author has made a critical inquiry into the circumstances relating to the early history of the Greenwich register, and has drawn up an authoritative table of monthly rainfall for the long period of 89 years. The average annual rainfall is 24·36 in., and the number of rainy days 157. The greatest annual fall was 35·54 in. in 1903, and the least 16·38 in. in 1864. During the five months January to May no monthly fall exceeding 4·37 in. was recorded; but in the remaining seven months there were 24 falls exceeding 5 inches, distributed in the following proportion :—June 3, July 8, August 2, September 1, October 6, November 2, and December 2. Light falls of rain are spread principally through the nine months January to September, with a decided preponderance in spring. Of falls to a less amount than 0·3 in. per month, 5 have been recorded in the month of April, 4 in February, 3 each in March, May and July, 2 in January, June and September, and 1 in August.

An interesting discussion ensued, which was taken part in by the President, Mr. W. Marriott, Mr. W. Ellis, F.R.S., Mr. F. J. Brodie, Mr. C. Harding, Dr. H. R. Mill, and Dr. H. N. Dickson, and Mr. W. C. Nash replied.

ROYAL OBSERVATORY, GREENWICH.

THE Annual Visitation of the Royal Observatory took place on Saturday, June 4th. A large number of scientific men were, as usual, invited to visit the Observatory, the various buildings of which were open for inspection, and as the day was fine, the visit was enjoyable.

The Board of Visitors—which consists of six representatives from the Royal Society, and six from the Royal Astronomical Society, as well as the Savilian Professor of Astronomy at Oxford, the Plumian Professor of Astronomy at Cambridge, and the Hydrographer of the Navy—met in the Octagon Room at 3 o'clock to receive the Report of the Astronomer Royal, Mr. W. H. M. Christie, F.R.S., on the work of the Observatory during the year ending May 10th, 1904. The Report dealt mostly with astronomical matters, but the following extracts will be of interest to meteorological readers:—

The solar activity has increased considerably during the year ending May 10, the Sun being free from spots on only 25 days, as against 100 in the previous year. The mean daily spotted area for 1903 is nearly six times as great as for 1902; still, as yet, the rate of increase is not so great as in the corresponding periods of the two preceding cycles. The greatest outburst of the year commenced on October 5, 1903, with the appearance at the east limb of the Sun of a group of spots much larger than any seen since September, 1898. Several fine groups have appeared since, particularly those first seen on October 25, October 30, November 5, November 30, 1903, and April 21, 1904.

The mean magnetic declination for 1903 was 16° 19′ West, and the mean dip 67° 0′ 51″.

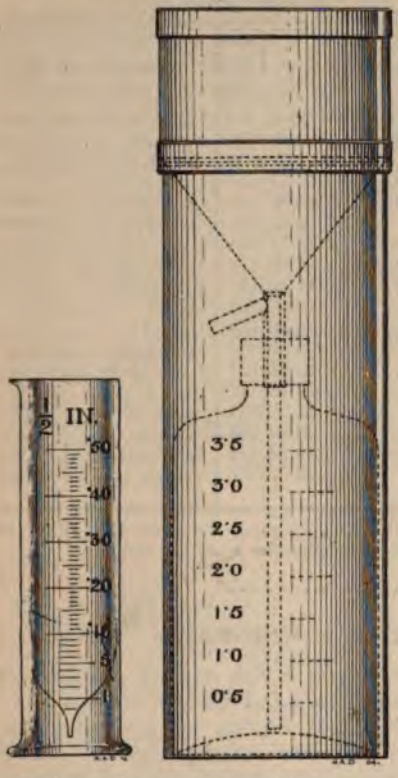
The mean temperature for the year 1903 was 50°·2, or 0°·7 above the average for the 50 years 1841–90.

The rainfall during 1903 was 35·54 in., the heaviest ever recorded at Greenwich during one calendar year. The summer months in particular were very wet, more than 16 inches being recorded in June, July and August—viz., 6·07 in. in June, 5·27 in. in July, and 4·82 in. in August. The greatest fall registered at Greenwich in a single day for many years past—viz., 2·46 in.—occurred on July 23. In 1904, January and February were wet months, so that the total fall from March 1, 1903, to February 29, 1904, was over 37 inches.

A Fineman nephoscope has been provided for cloud observations in connection with the international balloon ascents.

Mr. W. Carpenter Nash retired on December 31, after a long and honourable connection with the Observatory of nearly 48 years, having been for the last 10 years Superintendent of the Magnetic and Meteorological Branch. He has been succeeded by Mr. W. W. Bryant.

A NEW PATTERN OF RAIN GAUGE.



MESSRS. LANDER & SMITH, of Canterbury, have recently brought out a new pattern of rain gauge which contains some interesting features. The standard pattern of Snowdon rain gauge is not likely to be displaced where durability and good workmanship outweigh the necessarily somewhat high price; and it undoubtedly ought to continue to be the standard. Still, Messrs. Lander & Smith have produced a rain gauge which is accurate and cheap, and appears likely to last well with careful handling. The material is japanned zinc and the chief novelty is that the receiving vessel is a glass bottle permanently fixed to the funnel, the tube of which passes through a cemented cork and reaches almost to the bottom. A second short tube, like the spout of a soda-water syphon, permits of the contents of the bottle being emptied for measurement into the ordinary glass, which we are glad to notice is conical below and has a mark to indicate ·005 in., the quantity which determines whether or no a day is to be classed as rainy. The bottle itself is graduated in half inches of rain, a precaution which we commend as it is a valuable check on the graduated glass, making it practically impossible to mistake the number of half-inches which fall during heavy rain

Some observers will doubtless be inclined to try the new gauge, though many will greatly prefer the old and tried pattern. We welcome, in the new instrument, the indication it affords of living interest in the subject of rainfall measurement, and of a desire to supply instruments of good quality at a moderate price. In such circumstances competition is wholesome and deserves encouragement.

THE FIVE MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—May, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	9·60	124	Arncliffe	29·66	129	Braemar	11·34	95
Tenterden	11·38	128	Hull	8·73	103	Aberdeen	14·02	125
Hartley Wintney	12·22	141	Newcastle.....	10·17	118	Cawdor	9·52	95
Hitchin	...	...	Seathwaite ...	62·60	119	Glencarron ..	37·09	107
Winslow	10·59	133	Cardiff	19·63	145	Dunrobin	13·24	119
Westley	9·09	110	Haverfordwest	19·15	124	Killarney ...	24·15	122
Brundall.....	9·27	114	Gogerddan ...	18·03	118	Waterford ...	18·54	130
Alderbury	14·32	147	Llandudno ...	11·13	111	Broadford... ..	16·39	138
Ashburton	27·11	143	Dumfries	17·25	106	Carlow	14·59	117
Polapit Tamar ...	20·88	166	Lilliesleaf	13·56	129	Dublin	11·75	120
Stroud	12·83	134	Colmonell	16·19	100	Mullingar.....	16·77	129
Woolstaston	12·69	122	Glasgow	15·64	121	Ballinasloe ...	16·96	130
Boston	7·41	109	Inveraray	30·50	112	Clifden	35·56	123
Hesley Hall	9·05	127	Islay	21·23	131	Crossmolina ...	26·96	138
Derby.....	9·90	126	Mull	26·56	128	Seaforde	15·37	115
Bolton	15·33	117	Loch Leven ...	15·24	118	Londonderry..	15·99	113
Wetherby	12·86	158	Dundee	12·05	121	Omagh	18·49	136

NOTE.—In the above Table the first column gives the total rainfall of the five months, not, as in former years, the difference from the average.

SOUTH AFRICAN RAINFALL.

AN important paper on the Study of South African Rainfall was presented to the South African Philosophical Society in Cape Town, on December 29th, 1903, by Mr. J. R. Sutton. It gives a history of Kimberley rainfall from 1877 to 1902, and discusses the annual, monthly, daily and hourly quantities, both statistically and by means of harmonic analysis. The following notes are from an abstract of the paper in which quantities are expressed in vulgar fractions, as the limit of accuracy is evidently intended to be only to the nearest quarter inch it would be misleading to translate these into decimals, so that we must apologize for introducing this rather clumsy notation in our pages.

Mr. Sutton gives the heaviest annual fall at Kimberley as 31¼ inches in 1891, the least as 8¾ inches in 1897. This range he points out is less than that of similarly-situated places in Australia and India but greater than in South America. In Great Britain it is usual to find the wettest year with about twice the rainfall of the driest; in Kimberley we see that in a record of only 26 years' duration the wettest year had four times as much rain as the driest. The greatest daily fall was more than 4½ inches, and we suppose *that* this means less than five inches. The last week of February

was the wettest, and the first week of August the driest time of the year.

The hourly variation of rainfall gave a curve which is nearly the inverse of the barometric oscillation and is closely connected with the dew-point curve. Rather more rain fell at night than during the day, but the rate of fall was greater in the day time. The relation of wind to monthly rainfall was found to be that the amount of rain decreased when the wind varied from its normal direction for the month.

A comparison was made between Kimberley and other places in South Africa, the wettest cited being Maclear's Beacon on Table Mountain with 87 inches, the driest Port Nolloth with only 2½ inches in the year.

The author's conclusion is that the rain of central South Africa originates in the main in the Doldrums, being reinforced more or less by the moisture evaporated from the Indian Ocean; and that the aridity of the west coast is not caused, as Dr. Buchan believes, by the southern anticyclonic belt, but simply by the coldness of the water. The passage as to the Doldrums is somewhat obscure; possibly it may be a slip for the Calms of Capricorn; but the full paper will of course make the matter clear.

REVIEWS.

The Climate of Australasia in reference to its control by the Southern Ocean, by Professor J. W. GREGORY, D.Sc., F.R.S. Melbourne, Whitcombe and Tombs, Ltd. Size 7½ × 5. Pp. 96.

THE versatile professor of geology, whose appointment to the University of Glasgow we rejoice to see, while holding a similar chair in the University of Melbourne, delivered a presidential address to the Dunedin meeting of the Australasian Association for the Advancement of Science on January 11th, 1904, upon the climate of Australasia, which he has now expanded into a plump pamphlet. Professor Gregory accepts as proved the existence of weather cycles, precise and recognisable enough to furnish a sure basis for long period weather forecasts, basing his opinions largely on the experience of the Indian meteorological service. We fear, however, that he does not make adequate allowance for the difference between the climatic conditions of the tropical and the temperate zones when he attempts to apply to southern and temperate Australasia deductions from observations made in tropical India. We are glad to see that Professor Gregory holds that long period forecasts will continue impossible until meteorology has advanced another stage, and we sympathise with his hope that the publication of this pamphlet will do something to help forward the proposals for the establishment of a united meteorological service for Australasia.

We are sure that it is wholly good that men who pursue one branch of physical science should occasionally look over the field of their neighbours, and bring to other specialists the advantage of a fresh eye and the suggestions of a mind untrammelled by the inevitable precautions and hesitations which impede the specialist in reaching a little beyond the facts with which he deals daily. Professor Gregory has read widely, and supports his arguments with numerous references to original sources of information, and his pamphlet is bound to be of service to all who read it. So far as Australasian meteorology is concerned, we may rest assured that the Antarctic expeditions now returned or returning to Europe will bring an immense addition to our knowledge of the Southern Ocean, which will provide meteorologists in the temperate parts of the southern hemisphere with very valuable material.

Nedböriagttagelser i Norge. Udgivet af det Norske Meteorologiske Institut. Aargang IX. [Rainfall Observations in Norway. Published by the Norwegian Meteorological Institute. Ninth year.] 1903. Size $15\frac{1}{2} \times 11\frac{1}{2}$. Pp. xviii. + 126. Christiania, 1904. Price 6 kr.

We have again to congratulate Professor Mohn on being first in the field with his account of Norwegian Rainfall for 1903. We know of no other official meteorological institution which is so prompt in publishing its annual volume, and our object in singling this out from the mass of annual reports for one, two or three years ago which we have received during the last few months, is to hold it up as an example which larger and richer nations than Norway would do well to follow.

U.S. Department of Agriculture. Weather Bureau Bulletin L. Climatology of California. Prepared by Alexander G. McAdie, *Professor of Meteorology.* Washington, 1903. Size 12 × 9. Pp. 270. *Plates, &c.*

Different sections of this memoir are treated by different authors, and the general results are pointed out by Professor McAdie, though less fully than we should like to see. We are glad to notice that attention is paid to the distribution of climate in typical months of different character. While we are far from considering the determination and use of averages as valueless in climatological discussions, we feel strongly that they should be reinforced by a discussion of typical normal and extreme years, months, and even days. The volume before us is well illustrated by maps and diagrams, and it contains a selection of Professor McAdie's own fine photographs of clouds—or fog—from Mount Tamalpais.

METEOROLOGICAL NEWS AND NOTES.

THE "CAMDEN" RAIN GLASS has been designed by Messrs. Negretti and Zambra in order to include all the improvements suggested by recent correspondents in this Magazine. The scale is more clearly marked, the half-tenths being indicated on the left hand side, an undoubted improvement, while the lower part is conical so as to enable the first hundredth to be distinctly subdivided. This removes the decision as to whether the amount is sufficient to justify it to be entered as nearer ·01 than ·00, and so to give a nominal "rainy day," from the region of guessing. This is a very important feature, for it compels the maker to calibrate the first two divisions, and thus overcomes the most fruitful cause of variation in the number of rainy days assigned to a station. A third addition is a duplicate scale on the back, which is liked by some observers, though we confess we can obtain accurate readings without its aid: still it can do no harm. The new glass is necessarily a little more expensive than the usual pattern.

THE BEN NEVIS OBSERVATORIES have been the subject of an interchange of correspondence in the Scottish press in connection with statements made by Lord McLaren at the recent meeting of the Scottish Meteorological Society. Lord McLaren stated that the Meteorological Office had "never made the slightest use of the observations furnished to them" from Ben Nevis and did not utilize these observations for weather forecasts. Sir Herbert Maxwell, as Chairman of the Treasury Committee on the expenditure of the Meteorological Grant, after rebutting certain allegations as to the conduct of his Committee, replied to the charge that the information telegraphed from Ben Nevis was supplied to the Meteorological Council by the Directors subject to the definite proviso that it should not be published in a "form which would anticipate the daily reports from Ben Nevis which are supplied to the newspapers." It was on this account that the Meteorological Office requested that the telegrams be discontinued, because without the right of publication they could not be utilised. Lord McLaren, in reply, said the observations might have been used for forecasting without publication. We greatly regret the delay in the completion and issue of the report of the Treasury Committee, the earlier appearance of which might possibly have prevented a controversy which seems more likely to hurt than to help the cause of meteorology in Great Britain.

THE GERMAN METEOROLOGICAL SOCIETY held its tenth general meeting at Berlin from April 7th to 9th, 1904. The President, Professor von Bezold, gave an introductory address, visits were paid

to various observatories and places of interest to meteorologists, and the following amongst other papers were read:—On the influence of forests on climate, by Professor Schubert of Eberswalde; On the variations in water-temperature on the western coasts of Europe, by Dr. Meinardus of Berlin; On the thermal régime on the continents, at sea and in the atmosphere, by Professor Schubert; On the tides of the atmosphere, especially on the movements during ebb, by Professor Möller of Brunswick; On the movements of summer rains across Germany, by Dr. Less of Berlin; On precipitation in cyclones, by Dr. Polis of Aix-la-Chapelle; and On the meteorological causes of the winter-killing of grain.

Mr. R. C. Mossman, the accomplished meteorologist of the Scottish Antarctic Expedition, has remained in the South Orkney Islands while his companions, after a second cruise to high latitudes, have returned in the "Scotia," and are due to reach the Clyde about the beginning of July. Mr. Mossman has taken charge of a staff of observers from the Argentine Republic, who are supported by their government. The result will be a second year's observations in a most interesting position on the edge of the Antarctic. Mr. Mossman sends a poetical New Year's greeting to his friends (the mails are infrequent) from Omond House, Scotia Bay:—

"From this most salubrious spot, where the weather's never hot,
And the snow keeps merrily drifting all the year,
Where the sun is seldom seen, and the hills are never green,
And the mighty bergs are always very near."

Measuring the Rainfall is the heading of a letter recently addressed to the editor of the *Journal of Commerce*, Liverpool, which runs thus:—

Sir,—The following method of measuring the rainfall may interest and amuse Mr. Hugh R. Mill:—

A good many years ago an old friend of my father's had a rain gauge in his grounds, which he carefully watched and recorded its readings daily. One summer he went from home for a short holiday, and the first thing he did on his return was to visit the gauge, which, to his great surprise, the weather having been fine in the interval, contained a good deal more water than when he had last sounded it. Whilst puzzling over the matter, his old housekeeper came out of the house, and, seeing what her master was after, astonished him by saying: "Oh, sir, it's all right; I put a wee drap in every day since ye went away."—Yours, &c.

April 9th, 1904. Aquarius.

No doubt the anecdote will amuse our readers also.

METEOROLOGY ON THE ANTARCTIC EXPEDITION.

THE Rev. D. C. Bate has been kind enough to forward from New Zealand copies of the *Canterbury Times* for April 13th and 20th, 1904, containing some admirable reproductions of photographs of Antarctic life and scenery, together with descriptive articles on the expedition of the "Discovery," and on the scientific results written from data supplied by the members of the expedition. The meteorological work is described in considerable detail, no less than four and a half columns being devoted to details of the instruments used and the results obtained. So far as actual figures are concerned the only new records quoted are the minimum temperatures for April and May, 1903. These were at the ship's winter quarters, —43°·0 for April and —52°·2 for May, and at Cape Armitage, —56°·0 for April, and —67°·7 for May.

With regard to the anemometers the article says:—

"Of mechanical instruments we have one Robinson cup anemometer, a small Dines', and also another of Dines', which records the maximum force the wind has blown since the last observation, and the mean force at the present time, but as this has not been working at all satisfactory we will not deal with it in this paper. Our anemometers have had their work to do down here, and it cannot be said that they have wholly succeeded. In fact, the constant drift-snow effectually chokes and stops the working of both the Dines'. The Robinson has kept going to a large extent, but has had to be repaired several times, when the cups worked loose, or when snow accumulated inside the works. In the small Dines' the snow not only got inside the head but also down into the piping, and at last effectually stopped any record. The large Dines', which is a self-recording instrument, has been going more or less continually, and very interesting are the curves traced on the sheet, but this, again, soon gets choked, and it is no joy having to climb up the mizzen rigging to clear the head when a gale is blowing, and the temperature is well into the minus sign."

We have also heard from Captain Scott and Lieutenant Royds, but their letters do not contain any facts for publication. They state, however, that from the point of view of scientific observations the second year spent in the shadow (or perhaps we ought to say in the glare) of Mount Erebus was even more successful than the first. It is gratifying to know that so far from the second winter breaking down the health of the ship's company, it was not felt so severely as the first, though the temperatures recorded were considerably lower.

RAINFALL AND TEMPERATURE, MAY, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	1·96	+ ·40	·36	31	16	76·6	16	34·1	9	0	4
II.	Tenterden	2·04	+ ·23	·47	31	15	77·0	26	34·0	9	0	3
,,	Hartley Wintney ...	2·87	+ 1·01	·97	20	15	72·0	29	32·0	9	1	3
III.	Hitchin	...	...	...	...	...	...	...	...	...	...	...
,,	Winslow (Addington) ...	2·18	+ ·47	·53	20	17	71·0	16	34·0	3, 20	0	5
IV.	Bury St. Edmunds (Westley)	2·14	+ ·30	·38	31	15	76·0	27	35·0	10	0	...
,,	Brundall	1·80	— ·01	·45	31	13	75·2	26	34·8	10	0	1
V.	Alderbury ...	2·86	+ 1·17	·78	27	16	71·0	29	33·0	8	0	...
,,	Winterborne Steepleton ...	4·47	...	1·10	23	18	67·2	16	33·5	20	0	5
,,	Torquay (Cary Green) ...	2·37	...	·38	30	18	64·0	27, 28	39·3	9	0	0
,,	Polapit Tamar [Launceston]	2·97	+ ·73	·62	1	21	72·8	16	32·7	20	0	2
,,	Bath ...	1·97	...	·50	27	14	71·0	16	36·2	11	0	...
VI.	Stroud (Upfield) ...	1·86	— ·03	·43	20	14	70·0	29	37·0	10	0	...
,,	Church Stretton (Woolstaston)	2·27	— ·03	·39	1	17	68·0	16	32·0	8	1	...
,,	Bromsgrove (StokeReformatory)	4·01	+ 2·50	2·20	27	15	67·0	26	30·0	...	5	...
VII.	Boston ...	1·32	— ·18	·50	31	5	75·0	16	33·0	10	0	...
,,	Bawtry (Hesley Hall) ...	1·74	+ ·20	·48	31	14	...	...	...	...	...	...
,,	Derby (Midland Railway) ...	1·81	— ·04	·46	6	19	74·0	26	35·5	7	0	...
VIII.	Bolton (The Park) ...	2·93	+ ·19	·49	31	17	70·5	26	34·2	8	0	5
IX.	Wetherby (Ribston Hall) ...	3·34	+ 1·67	1·13	27	18	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	4·53	+ 1·14	·75	1	21	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	2·12	+ ·31	·54	6	17	71·0	13	35·0	10, 20	0	3
X.	Newcastle (Town Moor) ...	2·84	+ 1·09	·70	27	17	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	7·68	+ ·34	1·99	23	18	70·4	26	34·5	8	0	...
XI.	Cardiff (Ely) ...	3·04	+ ·69	·46	24	20	...	...	...	...	...	...
,,	Haverfordwest (High St.) ...	2·93	+ ·64	·74	23	18	69·2	29	36·4	4, 11	0	5
,,	Aberystwith (Gogerddan) ...	3·45	+ ·93	1·00	27	15	77·0	26	30·0	7, 19	3	...
,,	Llandudno ...	1·85	+ ·02	·54	27	14	76·0	16	36·8	8	0	...
XII.	Cargen [Dumfries] ...	2·48	— ·16	·68	1	13	69·5	30	33·0	20	0	...
XIII.	Edinburgh (Royal Observy.)	2·88	...	·60	8	21	68·7	16	32·8	8	0	5
XIV.	Colmonell	2·28	— ·18	·45	23	16	77·0	29	33·0	19	0	...
XV.	Tighnabruaich ...	4·34	...	1·12	23	19	65·0	30	32·0	7	1	1
,,	Mull (Quinish) ...	3·84	+ ·69	·98	1	18	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	3·25	+ ·96	·81	24	19	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	2·50	+ ·74	·60	5	20	66·2	29	34·0	8, 12	0	...
XVII.	Braemar ...	2·12	— ·07	·62	1	15	70·5	30	28·8	12	5	13
,,	Aberdeen (Cranford) ...	2·86	+ ·85	·75	5	18	62·0	25	32·0	11, 19	2	...
,,	Cawdor (Budgate)	2·22	+ ·12	·33	26	16	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	5·74	+ ·49	·68	14, 18	22	75·8	30	32·0	8	1	...
,,	Bendamph. ...	6 22	+ 2·04	1·25	1	19	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	1·50	— ·43	·37	18	9	61·0	16	35·0	8	0	...
,,	Castletown	1·39	...	·44	26	17	62·0	26, 31	31·0	20	1	...
XX.	Killarney ...	3·11	+ ·06	·81	6	15	68·5	28	34·0	8	0	...
,,	Waterford (Brook Lodge) ...	2·42	— ·23	·51	4	15	65·0	28	34·0	4, 11	0	...
,,	Broadford (Hurdlestown) ...	3·00	+ ·77	·69	5	15	68·0	29	38·0	24	0	...
XXI.	Carlow (Browne's Hill) ...	3·00	+ ·70	·79	31	15	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	2·69	+ ·79	1·09	31	18	69·6	16	37·5	8	0	0
XXII.	Ballinasloe	2·80	+ ·35	·87	5	20	74·0	29	32·0	4, 8	2	...
,,	Clifden (Kylemore House) ...	4·44	— ·18	1·53	5	15	...	...	...	...	...	...
XXIII.	Seaforde	3·08	+ ·77	·79	31	17	73·0	16	32·0	7	1	1
,,	*Londonderry* (Creggan Res.)	2·65	+ ·01	·51	31	20	...	...	...	...	...	...
,,	*Omagh (Edenfel)* ...	2·39	— ·15	·47	1	16	71·0	27, 29	36·0	26	0	...

+ Shows that the fall was above the average; — that it was below it.

SUPPLEMENTARY RAINFALL, MAY, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	2·76	XI.	New Radnor, Ednol	2·21
,,	Sheppey, Leysdown	1·79	,,	Rhayader, Nantgwillt	2·65
,,	Hailsham	3·36	,,	Lake Vyrnwy	2·82
,,	Crowborough	3·45	,,	Ruthin, Plâs Dràw	1·86
,,	Ryde, Beldornie Tower	3·42	,,	Criccieth, Talarvor	2·35
,,	Emsworth, Redlands	3·76	,,	Anglesey, Lligwy	1·50
,,	Alton, Ashdell	3·58	,,	Douglas, Woodville	3·17
,,	Newbury, Welford Park	3·22	XII.	Stoneykirk, Ardwell House	2·37
III.	Harrow Weald	2·01	,,	Dalry, Old Garroch	3·32
,,	Oxford, Magdalen College	2·89	,,	Langholm, Drove Road	3·76
,,	Banbury, Bloxham	2·25	,,	Moniaive, Maxwelton House	2·85
,,	Pitsford, Sedgebrook	2·22	,,	Lilliesleaf, Riddell	2·93
,,	Huntingdon, Brampton	1·65	XIII.	N. Esk Reservoir [Penicuick]	4·20
,,	Wisbech, Bank House	...	XIV.	Maybole, Knockdon Farm	2·70
IV.	Southend	1·65	,,	Glasgow, Queen's Park	3·36
,,	Colchester, Lexden	1·63	XV.	Inveraray, Newtown	4·07
,,	Saffron Waldon, Newport	1·39	,,	Ballachulish, Ardsheal	6·75
,,	Rendlesham Hall	2·46	,,	Campbeltown, Redknowe	2·17
,,	Swaffham	1·76	,,	Islay, Eallabus	2·97
,,	Blakeney	1·51	XVI.	Dollar	3·09
V.	Bishop's Cannings	3·03	,,	Balquhidder, Stronvar	5·38
,,	Ashburton, Druid House	2·92	,,	Coupar Angus Station	2·40
,,	Okehampton, Oaklands	3·51	,,	Blair Atholl	1·45
,,	Hartland Abbey	3·05	,,	Montrose, Sunnyside	2·58
,,	Lynmouth, Rock House	2·77	XVII.	Alford, Lynturk Manse	2·88
,,	Probus, Lamellyn	2·98	,,	Keith, H.R.S.	2·69
,,	Wellington, The Avenue	2·39	XVIII.	Fearn, Lower Pitkerrie	·86
,,	North Cadbury Rectory	3·06	,,	S. Uist, Askernish	3·48
VI.	Clifton, Pembroke Road	3·19	,,	Invergarry	5·55
,,	Moreton-in-Marsh, Longboro'	3·89	,,	Aviemore, Alvie Manse	3·67
,,	Ross, The Graig	2·11	,,	Loch Ness, Drumnadrochit.	3·01
,,	Shifnal, Hatton Grange	2·03	XIX.	Invershin	1·54
,,	Wem Rectory	1·99	,,	Altnaharra	1·74
,,	Cheadle, The Heath House.	1·98	,,	Bettyhill	1·01
,,	Coventry, Kingswood	1·32	,,	Watten, H.R.S.	1·26
VII.	Market Overton	1·37	XX.	Cork, Wellesley Terrace	2·26
,,	Market Rasen	1·60	,,	Darrynane Abbey	3·28
,,	Worksop, Hodsock Priory	1·96	,,	Glenam [Clonmel]	2·93
VIII.	Neston, Hinderton	2·10	,,	Ballingarry, Hazelfort	3·26
,,	Southport, Hesketh Park	1·74	,,	Miltown Malbay	1·83
,,	Chatburn, Middlewood	3·11	XXI.	Gorey, Courtown House	1·99
,,	Duddon Valley, Seathwaite Vic.	4·05	,,	Moynalty, Westland	2·75
IX.	Langsett Moor, Up. Midhope	3·17	,,	Athlone, Twyford	2·21
,,	Baldersby	3·84	,,	Mullingar, Belvedere	2·52
,,	Scalby, Silverdale	3·27	XXII.	Woodlawn	2·55
,,	Ingleby Greenhow Vicarage	4·18	,,	Westport, Murrisk Abbey	3·09
,,	Middleton, Mickleton	3·05	,,	Crossmolina, Enniscoe	3·82
X.	Beltingham	2·56	,,	Collooney, Markree Obsy	2·64
,,	Bamburgh	2·36	XXIII.	Enniskillen, Portora	1·97
,,	Keswick, The Bank	3·30	,,	Warrenpoint	2·33
,,	Melmerby Rectory	4·51	,,	Banbridge, Milltown	2·19
XI.	Llanfrechfa Grange	3·12	,,	Belfast, Springfield	2·92
,,	Treherbert, Tyn-y-waun	4·96	,,	Bushmills, Dundarave	2·41
,,	Llandovery, Tonn	2·61	,,	Stewartstown	2·51
,,	Castle Malgwyn	1·78	,,	Killybegs	1·80
,,	Llandefaelog-fach	2·29	,,	Horn Head	2·05

METEOROLOGICAL NOTES ON MAY, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The absence of E. wind, and a sufficiency of sunshine and warm R, following a particularly mild April, combined to produce one of the most beautiful spring months for many years. The average amount of cloud for the month was 7·3, the highest on record, but there were nevertheless many magnificent days, especially in the first and third weeks. The duration of sunshine was 128·4* hours and of R 58·2 hours. Mean temp. 54°·6, or 0°·6 above the average,

TENTERDEN.—A pleasant spring month without much wind, though somewhat deficient in sunshine. Rather cold from 3rd to 11th and about 20th. Great abundance of blossom in orchards and on hawthorn and flowering shrubs. Duration of sunshine 158† hours.

CROWBOROUGH.—A very changeable type of weather. Mild on the whole, with frequent fog, mist and haze. Mean temp. 51°·8.

HARTLEY WINTNEY.—A "Janus-like" month, with one face excessively dry, the other remarkably wet. Cold N.W. wind for the first 19 days, then S.W. to the end. Ozone on 15 days with a mean of 2·9.

BRUNDALL.—Very fine, and the warmest May since 1895. From 8th to 20th it was absolutely rainless, this being the longest period without R since the end of June, 1903. Fruit blossoming proceeded almost without a check, promising an abundant crop.

WINTERBOURNE STEEPLETON.—The wettest May since the record began in 1893.

TORQUAY.—R ·37 in. above the average. Duration of sunshine 183·3* hours, or 38·0 hours below the average. Mean temp. 52°·8, or 0°·3 below the average. Mean amount of ozone 5·7; max. 8·0 on 2nd with W. wind, and min. 1·5 on 27th with N.N.E. wind.

LYNMOUTH.—Fairly warm, with no heavy gales. The range of bar. was only ·65 in.

WELLINGTON.—Very seasonable on the whole, but R ·75 in. above the average.

NORTH CADBURY.—A very good average May, but no settled weather. Temp. normal, the max. being a little lower and min. higher than usual. Fruit blossom was very abundant.

CLIFTON.—The first 10 days were rainy and cool; then fair and warmer till 19th, but not much sunshine. The remainder was rainy and unsettled. No frost. R ·92 in. above the average.

ROSS.—Average temp. and R, but more rainy days than usual. Much fine weather from 2nd to 20th, then frequent R to the close. Vegetation was very luxuriant and flowering shrubs unusually full of blossom.

WEM.—Showery and cold in the first half, without much sun and very damp on several days. Vegetation was well advanced and more than usually luxuriant.

BROMSGROVE.—On 27th 2·20 in. of R fell in about 10 hours. This fall has only been exceeded twice in 28 years.

WORKSOP.—Dry till near the end, and the R of the last few days was very welcome. Crops looked well and there was an unusual profusion of bloom on all trees and shrubs.

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* Campbell-Stokes. † Jordan.

BOLTON.—Very slight range of pressure and temp. The amount of cloud was much in excess, and the sunshine and evaporation were the least yet recorded. Mean temp. 48°·8, or 1°·0 below the average. Duration of sunshine 92·5* hours, or 63·3 hours below the average.

SOUTHPORT.—The most sunless May in 13 years' record, the mean being 69* hours below the average. Otherwise fairly normal. R ·38 in. below the average, the duration being only 40·7 hours. Mean temp. 0°·3 above the average.

HULL.—The early part was variable and frequently cold. Brighter from 14th to 20th, but very cloudy and milder towards the end. Duration of sunshine 79·2 hours.

LLANDOVERY.—Cool and changeable especially after the 7th, but on the whole favourable to vegetation.

HAVERFORDWEST.—Fine but cold, with just sufficient R. Vegetation luxuriant, with a promise of abundant harvests. Duration of sunshine 125·2* hours.

DOUGLAS.—A repetition of February, March and April. Temp. persistently below the average and remarkable deficiency of sunshine. Gales blew for about half the month chiefly from N. Fruit blossom was prolific and foliage good, but spring was extremely late.

SCOTLAND.

LANGHOLM.—R ·77 in. above the average of 28 years.

MAXWELTON HOUSE.—A fine month, the first half being cold and the second warm. R ·24 in. below the average. S on 2nd.

LILLIESLEAF, RIDDELL.—R ·93 in. above the average. There was an excessive amount of blossom on fruit trees, probably owing to the absence of insects caused by last year's R.

INVERARAY.—The first half was cold and showery and everything very backward, but the last few days were quite hot.

BALLACHULISH.—R 3·18 in. above the average.

COUPAR ANGUS.—R and temp. slightly above the average. The first two weeks were cold and wet, but it was fine afterwards.

WATTEN.—The first half was dry, with cold, stormy winds; the latter half dry, mild and fine, particularly the closing week.

CASTLETOWN.—Cold and windy till 20th, afterwards warm and dry, the last few days being very dry and dusty. TS lasting nearly 2 hours on 26th.

IRELAND.

CORK.—Temp. 3°·8 below the average, and R ·08 in. above the average. On 8th the min. temp. 32°·0, the latest frost in 21 years.

DUBLIN.—The month opened and closed with heavy R, but the rest was fine though changeable. Very cold from 5th to 10th. H on 7th, 8th and 17th.

MARKREE OBSERVATORY.—Frequent R and H showers, with strong S. and S.W. winds, in the first half. Fine weather after 17th.

BELFAST.—A very satisfactory May, with many fine summer days. R ·07 in. above the average.

OMAGH.—The greater part was rather cool, blustering and unsettled, but practically without frost. The foliage and flowers, including that of fruit trees, was therefore more abundant and luxuriant than for many years. The month went out in settled summer weather.

Erratum.—In the notes for April, 1904, the mean temp. at Camden Square *should be* 50°·3 *not* 48°·1, and the difference from the average 2°·2, *not* 2°·4.

* Campbell-Stokes.

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Climatological Table for the British Empire, December, 1903.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	52·3	9	26·1	31	42·6	35·5	36·8	92	59·2	19·1	1·30	12	8·4
Malta	70·2	11	43·2	8	63·1	52·0	51·5	75	107·2	40·2	3·55	14	4·3
Lagos, W. Africa	91·0	8	71·0	20	87·8	75·2	77·3	75	143·0	70·0	1·23	5	3·6
Cape Town	90·8	14	50·2	21	76·6	67·9	56·5	68	...	...	·45	4	3·1
Durban, Natal	92·3	25	59·8	13	83·3	66·5	...	...	145·9	...	5·33	20	5·3
Mauritius	88·2	2	65·4	7, 11	83·8	69·3	66·2	72	153·8	60·8	2·74	21	6·1
Calcutta	80·4	12	49·8	16	76·3	54·0	52·8	65	135·0	42·5	·00	0	0·9
Bombay	91·2	3	56·0	27	84·7	68·5	63·4	66	138·5	48·9	·00	0	0·7
Madras	86·2	2	65·3	8	81·3	69·7	68·4	82	135·2	61·6	19·63	11	5·0
Kodaikanal	65·3	24	42·7	14	60·4	47·2	42·9	71	129·3	29·2	12·06	9	4·2
Colombo, Ceylon	90·0	4, 20	70·2	15	79·0	74·1	70·7	79	155·8	66·5	·92	7	4·5
Hongkong	74·7	15	45·8	21	66·9	56·0	45·6	56	124·1	...	·09	2	3·5
Melbourne	95·6	26	45·5	4	72·7	55·5	53·6	74	152·2	38·4	2·30	9	6·1
Adelaide	99·7	26	46·9	2	80·8	57·9	52·0	53	160·5	47·0	1·16	6	3·5
Coolgardie	...	...	...	...	...	...	...	..	...	...	...	...	...
Sydney	86·5	12	57·5	17	75·5	63·3	53·7	67	129·2	48·9	3·93	20	6·0
Wellington	78·7	9	48·5	27	70·9	55·8	51·9	67	138·0	44·0	1·81	11	6·0
Auckland	77·0	28	56·0	13	71·5	59·5	55·7	71	147·0	52·0	3·26	14	4·2
Jamaica, Negril Point.	87·9	15	65·0	9	85·2	70·5	68·0	71	...	...	·56	3	...
Trinidad	90·0	sevl	67·0	sevl	87·7	70·6	72·3	83	166·0	61·0	4·20	15	...
Grenada	87·2	11	70·8	29	83·6	73·1	69·3	70	154·2	...	12·49	24	3·6
Toronto	39·2	13	−9·7	28	29·6	16·2	17·8	81	45·8	−13·5	1·99	25	7·9
Fredericton	49·8	21	−10·7	29	27·0	6·5	5·5	61	...	...	3·36	8	5·8
Winnipeg	32·0	2	−29·8	25	13·2	−8·8	...	...	...	...	1·02	10	5·6
Victoria, B.C.	51·3	15	34·3	2	45·9	40·1	...	...	...	...	2·41	16	8·1
Dawson	32·4	23	−40·0	13	6·0	−5·0	...	...	...	...	·11	2	4·5

MALTA.—Mean temp. of air 56°·6 or 0°·4 above, mean hourly velocity of wind 10·2 or 1·0 below, averages. Mean temp. of sea 62°·7. T88 on 3 days; L on 29th.

Mauritius.—Mean temp. of air 2°·0, dew point 1°·9, and R 2·11 in., below averages. Mean hourly velocity of wind 11·1 miles, or 0·2 below average; mean direction E. by S.

MADRAS.—Bright sunshine 149·2 hours. Max. daily R 8·20 in. on 30th.

KODAIKANAL.—Mean temp. of air 52°·6. Mean velocity of wind 361 miles per day. Bright sunshine 168·6 hours.

COLOMBO, CEYLON.—Mean temp. of air 79°·0 or 0°·2, of dew point 0°·2, and R 2·20 in. or 4·06 in. below, averages. Mean hourly velocity of wind 9·2 miles, prevailing direction N. and N.W.

HONGKONG.—Mean temp. of air 61°·1. R ·92 in. below average. Bright sunshine 222·3 hours, or 32 above average. Mean hourly velocity of wind 12·0 miles; prevailing direction N.E. by E.

Adelaide.—Mean temp. of air 2°·0 below, R ·30 in. above, average. Some severe T88.

Sydney.—Mean temp. of air 0°·5 below, humidity 1°·4 below, and R 1·39 in. above, average.

Wellington.—Mean temp. 6°·4 above, R 1·93 in. below, averages.

TRINIDAD.—R ·60 in. below the 40 years' average.

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THE REPORT OF THE METEOROLOGICAL COMMITTEE.

In December, 1902, the Prime Minister appointed a Committee consisting of Sir Herbert Maxwell, M.P., F.R.S., Mr. J. A. Dewar, M.P., Sir W. de W. Abney, F.R.S., Sir F. Hopwood of the Board of Trade, Sir T. H. Elliott of the Board of Agriculture, Mr. T. L. Heath of the Treasury, Dr. R. T. Glazebrook, F.R.S., and Prof. J. Larmor, Sec.R.S., "to enquire and report as to the administration by the Meteorological Council of the existing Parliamentary grant, and as to whether any changes in its apportionment are desirable in the interest of Meteorological Science, and to make any further recommendations which may occur to them with a view to increasing the utility of that grant."

The Committee held twelve meetings for the examination of witnesses and received evidence from twenty-two representatives of various scientific bodies and government departments, whose names, in the order in which they were called, are given below:—General Sir R. Strachey, F.R.S., Chairman of the Meteorological Council; Dr. W. N. Shaw, F.R.S., Secretary of the Meteorological Council; Sir Michael Foster, M.P., F.R.S., Secretary of the Royal Society; Sir John Murray, F.R.S., Chairman of Directors of Ben Nevis Observatories; Dr. A. Buchan, F.R.S., Secretary of Scottish Meteorological Society; Admiral Sir W. Wharton, F.R.S., Hydrographer to the Admiralty; Commander D. Wilson Barker, R.N.R., President of the Royal Meteorological Society; Mr. W. H. Christie, F.R.S., Astronomer Royal; Mr. J. MacDonald, Secretary of Highland and Agricultural Society; Sir Norman Lockyer, F.R.S., Director of the Solar Physics Observatory; Lord Kelvin, F.R.S.; Professor George Darwin, F.R.S., Professor of Astronomy at Cambridge; Dr. R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory; Mr. R. T. Omond, Hon. Sec. Scottish Meteorological Society; Mr. E. K. Spiegelhalter, Optician, Malton, Yorks; Dr. H. R. Mill; Professor A. Schuster, F.R.S., Professor of Physics in Manchester; Mr. R. N. Grenville, of

the Royal Agricultural Society; Sir E. Verney, Steeple Clayden, Bucks; Captain A. MacDonald, Commander of Scottish Fishery Board's cruiser; Rev. V. F. Willson, Rector of Fullbeck, Lincolnshire; Mr. R. A. Dawson, Superintendent of the Lancashire Sea Fisheries.

The Committee has now issued its report, dated 16th May, 1904, and the full evidence of all the witnesses is also published.* Both documents should be studied by all who have the science of meteorology at heart and who desire to see it promoted for the benefit of the public. The report is important, the evidence is interesting in a high degree, and we do not hesitate to devote a large part of our space to the subject this month. The logical order would be to begin with the evidence and then consider the report; but as we are entirely in agreement with the majority of the Committee and consider that a better or fairer report could hardly have been based on the evidence before them, we shall in this article consider the report in detail and leave the evidence in the meantime.

Sir Herbert Maxwell's Committee considered five special points, and after a preliminary remark on the first, we summarise the conclusions seriatim without further comment until the end. The constitution of the Meteorological Council does not appear to have been understood before by the general public, and we confess that, like the reverend gentleman on the golf course, although we might never have uttered such a word ourselves, we felt a sense of relief when *The Times* "said it for us" and referred to the Council "as bearing a considerable analogy to the arrangements of comic opera."

The substance of the Report is as follows:—

(a) *Constitution of the Meteorological Council.*—The Meteorological Council is constituted upon a system which bears no analogy to that of other departments, administering money voted by Parliament. In 1856 a Meteorological Department of the Board of Trade was formed in accordance with the advice of the Royal Society, and placed under the control of Admiral FitzRoy. On his death, in 1865, a committee consisting of one representative each of the Board of Trade, the Admiralty, and the Royal Society, inquired into the work accomplished, and in conformity with its report, the control of the Meteorological Department was handed over, in 1867, to the Royal Society, who, in consideration of an annual grant of £10,000, undertook to appoint a standing committee (unpaid) to carry on the work, and established the Meteorological Office.

The Royal Society had first tried, but failed, to induce the Board of Trade to separate the collection and discussion of scientific data from the issue of storm warnings, considering that the latter should remain under a Government Department.

Nine years later, in 1875, another committee was appointed by the Treasury to review the work of the Meteorological Office. As a result of its

*Meteorological Grant Committee. Vol. I., Report. Size 13 × 8½. Pp. 20. Price 2½d. Vol. II., Evidence and Appendices. Size 13 × 8½. Pp. 122. Price 1s. [Cd. 2123, 2124.] London, Eyre and Spottiswoode, 1904.

report, the committee charged with the administration and control of the Meteorological Office was reconstituted in 1877 as the Meteorological Council, receiving an annual grant of £14,500, which was increased in subsequent years to £15,300, where it now stands.

The Council consisted of a chairman and four other members, all nominated by the Royal Society, £1,000 being allotted out of the grant for their remuneration. In addition to these, the Hydrographer was appointed *ex officio* a member of the Council. This arrangement was regarded as provisional and the Committee recommended its revision at the end of five years. The Royal Society pressed upon the Treasury, at this time and again in 1881, their view that the Meteorological Office should be constituted as "a Government Department, with a man of science, responsible to a Minister of the Crown, at the head of it." This view was not shared by the Government.

In 1901,* having obtained the approval of the Royal Society, the Council was incorporated under the Companies' Acts with a license from the Board of Trade enabling them to dispense with the word "limited," in order to obtain such benefits as limited liability, perpetual succession, and the right to sue.

The members of the Council became the Directors of the Association. But, whereas the statute requires that an association to be registered must consist of not less than seven persons, it became necessary to add to their number, which was done by the election of five members, the executive functions remaining exclusively in the hands of the five directors receiving emolument.

Thus was constituted what must be pronounced a singular anomaly—viz., a limited liability company, managed by a Board of five Directors receiving pay out of a grant made by Parliament, appointed by and presenting its annual report to the Royal Society, submitting its accounts for audit to the Comptroller and Auditor-General, but held bound under its Memorandum and Articles of Association to "observe any lawful conditions or directions imposed or given by the Lords Commissioners of the Treasury to the admistration of the said grant or the form of receipt to be given for payment of it."

(b) *Administration of the Annual Grant.*—Out of the sum of £1,000 a year originally assigned by the Treasury for the remuneration of the Directors, £875 is applied as follows, under the scheme approved by the Royal Society in 1900:—£300 to the chairman, £50 retaining fee to each of the Directors other than the Chairman and the Hydrographer. The balance remaining, £425, after deducting travelling expenses, is divided among the Directors, other than the Chairman, in proportion to their attendance at meetings, provided that no such Director shall receive more than £125 in any year in that way.

The staff in the Meteorological Office consists of a Secretary with a salary of £625 supplemented by his Director's fee of £125, a Marine Superintendent with £400, twenty-five classified clerks receiving various salaries from an initial £75 to a maximum of £275, fifteen other clerks, messengers, etc., and a special assistant to the Secretary for scientific investigations. The staff is distributed amongst five branches, viz.—The Secretary's Office, the Marine Branch, the Forecast and Storm-Warnings Branch, the Observatory Branch, and the Statistical and Library Branch. The grant is allocated amongst the branches as follows:—

* The Report gives the date as 1891, but that is a misprint.

Council and Secretary	£1,475
Secretary's Office, including rent	2,000
Marine Branch	2,434
Forecast Branch	3,560
Statistical and Library Branch	912
Observatory Branch	2,633
Inspections	400
Special Researches	726
Superannuation	1,220
Total	£15,360

The Marine Branch spends on the average £522 per annum in supplying meteorological instruments to ships of the Royal Navy, and £260 for a similar service to the mercantile marine. The Forecast Branch pays £2,060 to the Post Office, £260 for postage and £1810 for telegrams, which are charged at the ordinary rate and being subject to the usual conditions, frequently fail to be delivered in time. During the winter of 1902-03, storm-warnings were telegraphed to Tenby on 11 occasions at 7.30 p.m., and on 6 of these occasions they were not delivered until the following morning, 14 hours after the observations, on which they were founded, had been made. On another occasion the Post Office accepted 120 storm-warning telegrams one Sunday, charging 6d. each and an extra fee of 1s. each for Sunday delivery, and yet only 19 were delivered that evening, the £7 11s. 6d. paid for the others being absolutely wasted. The Library is inadequately housed, and as it contains 17,000 books and pamphlets to which 1,500 are added each year, the want of space is increasingly felt. The offices also are low-roofed and ill-ventilated, and the general routine of office work is estimated by the Council to demand an additional expenditure of £700 per annum.

With regard to the Observatory Branch the Council have been paying £1,910 per annum towards the maintenance of five observatories, viz.: Kew, Valencia, Falmouth, Aberdeen, and Fort William. They also receive observations from the observatories maintained by Stonyhurst College and Glasgow University.

Attention has been specially directed to the recent decision of the Council to discontinue the payment of £250 per annum to the Fort William Observatory, which was established as subsidiary to the observatory at Ben Nevis.

The important question whether the observatories should be retained or abandoned has been most carefully considered. The evidence on the subject is conflicting. Lord Kelvin still holds to the opinion expressed at the meeting of the British Association in 1887 that "the Ben Nevis observations are of the highest utility in the development of meteorology, and in framing forecasts of storms and weather," and he is of opinion that it is a matter for regret that these observations have not been used by the Meteorological Council in preparing their forecasts and warnings. On the other hand, Professor Schuster is of opinion that "the problems which could with convenience be carried out at Ben Nevis Observatory have been dealt with," and that further observations would be superfluous unless some definite problem were set for solution.

After weighing all the circumstances, it appears, that, on public and economic grounds, it would constitute a bad bargain to allow the observatories to disappear. Such a proceeding would involve the sacrifice of a large capital outlay which has been expended upon works, and the loss of the property and "good-

will" subsisting in the maintenance of the building and plant. It appears that only £350 per annum is required to insure the continued maintenance of the observatories, and every effort should be made to provide this small sum for the purpose.

Full accord has not always existed in the past between the Meteorological Council and the Directors of the Ben Nevis Observatory, and it seems that as a condition precedent to a continuance of the grant of £350, arrangements should be made for (1) a reorganisation of the management of these observatories, (2) a consideration of the general scientific purposes for which they might be used, (3) framing, with the assistance of meteorologists, a scheme defining the lines of investigation which should in future be undertaken at Fort William and Ben Nevis, and (4) securing to the Office the full right to publish telegraphic reports from Ben Nevis along with those from other stations.

With regard to meteorological research the Council has made a strong representation to the effect that the staff wants strengthening by the addition of assistants specially qualified by a knowledge of mathematics and physics, three such assistants would cost, with incidental expenses, £2,250 per annum. It also appears from the evidence that it would be desirable for the Council to have access to a meteorological laboratory properly equipped, which would serve as one of their first-order observing stations.

It appears that the present constitution of the Meteorological Office was never regarded by the Royal Society as a permanent one, but as "a temporary measure till some other organisation should be carried out." This seems to be a favourable opportunity for placing the Meteorological Office upon a permanent footing.

(c.) *Utility to the Public of the work of the Meteorological Council.*—The utility of the Maritime Branch is conceded; but some attention must be given to the work of the Forecast Branch in this particular, and the matter has been carefully enquired into.

Sea-faring men on all parts of the British coast where storm signals are displayed have become accustomed to regulate their movements in compliance with them. The fishing population also recognise their utility, although the increased use of steam trawlers has made fishing vessels less dependent on fair weather than formerly. It cannot be doubted that the system of storm-warnings has been effective in the protection of life and property at sea.

Farmers in those districts where timely information can be obtained are learning to take advantage of weather forecasts; but there is considerably more difficulty in distributing forecasts over wide agricultural districts than in communicating them to the centres of fishing population and coasting marine. Witnesses from different agricultural districts, remote from each other, estimate the proportion of accuracy in weather forecasts at from 70 to 90 per cent. It is to be regretted, therefore, that no effort seems to have been made on the part of agricultural societies to co-operate with the Council in the dissemination of this kind of information.

In the opinion of the Committee the economic value of weather forecasts and storm-warnings amply justifies the cost of maintaining them—a value which perhaps the public would never fully recognise until they should be discontinued.

After dealing with matters as they are at present, the Committee proceeds to recommend certain measures with a view to improvement,

and these are so important that we give them in the exact words of the Report :—

We are of opinion that the registration of the Meteorological Office as a company under the Joint Stock Companies' Act should be cancelled, that the company should be wound up, and the office reconstituted as a department under the control of the Board of Agriculture and Fisheries.

The necessity for a Council of seven having thus been got rid of, we recommend that the office be placed under the control of a man of science as Director of Meteorology, appointed after consultation with the Royal Society, but responsible to the Board of Agriculture and Fisheries, and making his annual report to that Department. We recommend also the appointment of an advisory board, consisting of the Hydrographer to the Admiralty, a representative of the Board of Trade and one of the Board of Agriculture and Fisheries, and two members nominated by the Royal Society. The functions of the advisory board should be consultative only, the Director being responsible to the Board of Agriculture and Fisheries for administration.

We recommend also that a second officer be appointed to act as scientific assistant to the Director, to assist him in the general management of the office and in the discussion of such scientific problems as may arise.

The mean annual cost of this arrangement, as compared with that for the present Council, we estimate thus :—

Present Arrangement.		Proposed Arrangement.	
Council	£850	Director ...	£800 rising to £1,000
Secretary	£625	Scientific Assistant	£450
	£1,475	Mean...	£1,350

The fixed Parliamentary Grant £15,300 should be transferred to the vote for the Board of Agriculture and Fisheries.

Under such an arrangement the anomaly would cease of what is practically a department of the public service, though nominally a joint stock company, paying for postal and telegraph services money out of its fixed income. The charge for these services would not appear in the estimate, though undoubtedly the revenue would be the loser by the amount now repaid out of the Parliamentary grant. The Director of Meteorology would not then feel, as the Council now do, that the more complete and rapid the distribution of forecasts and warnings is made, the less money remains for scientific research and for overtaking arrears in the statistical work of the department.

Further, we judge it important that the Post Office should make arrangements at the 27 reporting stations in the United Kingdom for the transmission of daily telegraphic reports one hour earlier than the present one of 8.15 to 8.30 a.m., and that storm warnings should, if practicable, have priority over all private messages at all hours.

We would call attention to the expediency of testing the efficacy of wireless telegraphy in providing advance news of weather in the Atlantic. Such news would incalculably strengthen the forecast and warning service, and might, we believe, be obtained regularly over an experimental period by co-operation either with the Admiralty, the Ocean Steamship Companies, or both. We would urge that no unnecessary delay should take place in organising this experiment.

We recommend that in future the cost of instruments supplied to His Majesty's ships be borne upon the Navy Votes, except where such instruments are intended for use in research or observation specially called for by the Director of Meteorology.

We consider that the premises now rented by the Council are neither suitable in character nor adequate in space for the present requirements of the office, and that others should be provided wherein the staff might perform their duties under more favourable hygienic conditions, and necessary accommodation for the rapidly growing library might be secured.

We recommend that the staff employed in the library, the statistical branch, and observatory branch, should be augmented. The steps necessary to give effect to this and the preceding recommendation can best be determined when the future of the office has been decided upon.

In default of an increase to the grant the small increased expenditure which we have recommended would have either to be postponed, or to be met from economies on other branches of the work of the office.

Unfortunately, the Committee was not unanimous in its report, various portions of it being taken exception to by different members. Thus, Sir Herbert Maxwell and Sir Wm. Abney dissent with some emphasis from the recommendation to continue support to the Ben Nevis observatories on the ground that their utility has not been proved. After stating reasons for this view, they conclude—"We are thus led to the conclusion that there is no ground for interfering with the discretion of the Meteorological Council in withdrawing their subsidy to these observatories and applying the £350 thus released to what they may consider more profitable methods of research." But they allow that an increase of the Parliamentary grant would alter the case.

Mr. Dewar dissents from the approval implied in the Report of the superannuation scheme adopted by the Council, on the ground that a large annual charge for pensions ought not to be made on a fund voted annually for a specific purpose.

Finally, Sir Francis Hopwood and Mr. Heath, representing the Board of Trade and the Treasury, object to all the recommendations of the Committee which involve an addition to the annual grant, on the ground that such matters were outside the reference, and they also object to the transference of the meteorological grant from the Vote for Scientific Investigations, &c., to the Vote for the Board of Agriculture and Fisheries, because they consider that the time has come for an inquiry into the whole question of grants in aid of scientific work.

It is a misfortune that the Report is not unanimous, for it may give the Government an opportunity to delay the steps necessary to give effect to those recommendations on which all were agreed. The difficulties raised do not strike us as overwhelming. If the Meteorological Office is reconstituted, with a Director of recognised scientific position and administrative ability at its head (and no better man than the present secretary could be found), it would surely be safe

to leave to him the responsibility for continuing or discontinuing the grant to any of the present observatories. The economies suggested by the substitution of a Director and scientific assistant with an unpaid advisory body for the present Council and Secretary would have the effect of practically increasing the grant, and after all the cost of one torpedo a year would not be money thrown away if it improved our knowledge of the weather. It would, in any case, be unwise to hamper the prospective Director by any definite instructions as to what he must do in any special case, the urgency of which may vary as time goes on.

It surely does not matter on what vote the money is given, so long as it is expended in the right way for the proper purpose and is as free as possible from the trammels of red tape. The Royal Society it appears never liked the constitution of the Meteorological Council, were always anxious to change it, and would view its reorganization as a Government department without regret. The Board of Agriculture and Fisheries has shown itself to be energetic and reasonable in the control of the Ordnance Survey, an institution in many ways akin in its relation to the public to the Meteorological Office, and the practical applications of meteorology apply mainly to the two great national industries the oversight of which is now under the charge of the Board. The feeling is unanimous that the anomalous Meteorological Council should cease and that a Government department should accept responsibility for the national weather service. But we cannot too strongly emphasize our opinion that the Government department must give an absolutely free hand to the Director of Meteorology and not exhaust his strength in trivial details or in trying to carry out or to evade vexatious regulations.

With one point in the decisions of the Committee we are particularly pleased. That is the frank manner in which the Post Office has been condemned for the obstruction it has systematically thrown in the way of the work of the Meteorological Office. In a smaller degree but no less vexatiously we have ourselves suffered from the perversity of Post Office officials with regard to regulations as to the postage exacted on meteorological communications not of the nature of a letter; and although the late Mr. Symons failed to obtain redress, even in Parliament, we trust that when the Treasury takes the matter up, the Post Office may at last be convinced that their function is to facilitate and not to frustrate the transmission of important information.

The Directors of the Ben Nevis Observatory deserve to be congratulated on the result of their public-spirited appeal to Parliament; for not only is the continuance of high-level meteorology insisted on in the Report of the Committee, but a reform in the treatment of meteorology in this country has been brought within sight which promises to be of high utility to the science and its applications.

We would suggest one modification in the recommendation as to an advisory Committee, which is that it be increased by the addition of a member nominated by the Royal Meteorological Society. This would in no way detract from the recognised position of the Royal Society as the scientific advisors of the Government, for an exact precedent is to be found in the constitution of the Board of Visitors at Greenwich, and we claim the same privilege for the Royal Meteorological Society in connection with Government meteorology which is conceded to the Royal Astronomical Society in the case of Government astronomy.

A NEW METEOROGRAPH FOR KITES.

By. W. H. Dines.

The want of a reliable meteorograph at a moderate cost is one that is often felt by those engaged in obtaining meteorological observations by means of unmanned balloons and kites, and it has been, to me at least, a serious difficulty in my work. The requirements are somewhat out of the common; the meteorograph must be light, it should offer little resistance to the wind, and the control over the pens should be sufficiently powerful to prevent the blurring of the trace by the violent shaking to which the instruments are at times exposed. It is also very desirable that no change of position, such as an alteration of level, should be able to alter the positions of the pens on the paper. It is hoped that these requirements are met in the instrument here described, and made by Mr. J. J. Hicks, of 10, Hatton Garden, London, E.C.

Simplicity of construction and small surface are secured by letting the pens write upon a circular paper disc of about 11 or 12 inches diameter instead of on a clock drum. This disc turns on a pin passing through a hole in its centre and lies on a flat piece of thin wood. It is turned at any rate that may be desired by an ordinary small clock, the paper near its circumference being pressed against the milled wheel that is used for setting the hands, by a small roller mounted on a spring.

The height, or more strictly the air pressure, is given by an aneroid box of $2\frac{3}{4}$ inches diameter. This box is formed of thin metal and is left full of air. There is in consequence a fairly large temperature correction to be applied, but, on the other hand, the elasticity of the enclosed air is perfect, and the elasticity of the metal plays a comparatively small part in determining the position of the pen. A stud on the box presses against a lever, and the other end of the lever is formed into a pen of special construction, which

will not easily blot. There is no difficulty in getting a sufficiently open scale by this means.

The thermograph consists of a coil of fine thin brass tube in communication with an aneroid box of about $1\frac{1}{4}$ in. diameter. The tube and aneroid box are completely filled with ether. Ether is chosen because its co-efficient of expansion is greater, and its specific heat less, than that of spirit, and in consequence the thermograph is more sensitive than it would be with alcohol. The expansion of the ether expands the aneroid box, and the motion of the face of the box is communicated to the pen by a single lever, just as in the case of the aneroidgraph. Any temperature scale can be arranged for, but 40° F. to one inch allows readings to be obtained with certainty within 1° F. in so far as deciphering the trace is concerned. Of course there is a certain lag, but it appears to be less than that of the ordinary mercurial thermometer.

The humidity-graph is obtained by the alteration in length of a few human hairs six inches long, the pen lever multiplying this eight times. Thus the pen exhibits on the paper the contraction and expansion of 4 ft. of human hair. The scale is about $\frac{1}{2}$ in. long.

It is hoped at some future time to add an anemograph.

The outside dimensions of the whole arrangement are 15 in. by 12 in. by 3 in. The paper disc, pens, clock, etc., enclosed and are protected from rain by a varnished linen cover, and the weight of the instrument, including the means of attachment to the kite, is about $1\frac{3}{4}$ lbs. The meteorograph is sent up in the kite, and is secured by four pieces of strong string running from its four corners to the top and bottom of the side sticks. It thus lies in the air slightly inclined to the wind, and advantage is taken of this position to protect the thermometer tube and hygrometer hairs from the sun. They are placed underneath where the wind blows freely over them and they must be in shadow unless the sun be low down on the horizon in the direction from which the wind is blowing. They are also thus protected from rain, but it is not possible to protect them from the driving fog particles of a cloud, and these are as wetting as rain.

Printed paper can be used, but it is simpler to cut circular discs of the required size out of ordinary drawing paper, and to decipher the traces by placing them under an engraved thin celluloid disc.

I have now used these instruments for a period of three months in all kinds of weather, and although on one occasion they were inadvertently placed in the kite upside down, they have on every occasion given a perfectly distinct trace free from blurring and easily decipherable.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

BALL LIGHTNING.

AT the recent meeting of the Royal Meteorological Society considerable doubt was expressed as to the objective reality of the above phenomenon, and I have made some enquiries into the matter with the following result.

Some years since (it is unfortunately impossible to fix the exact date) Miss Norton, while watching a very heavy thunderstorm one afternoon, witnessed a phenomenon which was certainly like "ball lightning."

She says :—"I was seated near the window working, when there came a sudden crash, and a *ball of fire* fell into the garden disappearing immediately into the earth. It did *not* explode or break into pieces.

"The following day I was invited to go in to the next house to see the damage done by the lightning, which was very great, the fireplace and chimney-piece being wrenched from their position, and the furniture in the room demolished.

"It would therefore seem that the electric ball descended the chimney of my neighbour's house, and, having wrecked the room, proceeded into the back garden, then, bounding over the wall, it disappeared in my own garden, much to my alarm. I regret to say that as that time my fear exceeded my interest in the matter, I did not go into the garden to look for traces of where the lightning entered the ground, and the subsequent very heavy rains erased all marks."

This, then, is the authentic statement of an eye-witness of the phenomenon of ball lightning, and I venture to think that instead of definitely stating that such lightning never occurs, it would be better to assume that although it is possible it is at the same time *very* rare.

D. W. HORNER.

Clapham Park, S.W., June 24th, 1904.

[We think that Mr. Horner scarcely grasps the difficulty with regard to "ball lightning." No one denies that it has frequently been seen ; the problem is whether the appearance of a ball of fire is the image of a real fireball, or is merely a subjective impression of some luminous phenomenon which may not be produced by a globular body at all.—ED. *S.M.M.*]

A THREE YEARS' PERIOD IN RAINFALL.

I HAVE just read Mr. Jenkin's communication in your June number, and I send you the result of an examination of my 30 years' observations at Montfaucon d'Argonne, near Verdun. The site is an

isolated hill of 1,150 feet altitude. The results show no agreement with those obtained at Trewirgie, nor do those at Paris for the same period which I add for comparison :—

MONTFAUCON D'ARGONNE.

Date of Col. I.	I.	II.	III.
1873.....	—	22·05	30·21
1876.....	31·59	40·29	39·44
1879.....	34·81	38·52	36·50
1882.....	46·46	41·38	30·27
1885.....	30·86	45·22	32·43
1888.....	47·27	39·57	30·72
1891.....	34·47	33·76	34·76
1894.....	30·45	32·93	35·29
1897.....	33·08	24·37	26·80
1900.....	25·24	28·91	26·52
1903.....	27·03	—	—
Mean	34·13	34·70	32·29

General Mean..... .. 33·17

PARIS (TERRASSE).

Date of Col. I.	I.	II.	III.
1873.....	—	16·62	20·06
1876.....	20·44	23·71	24·82
1879.....	17·66	19·05	19·06
1882.....	21·81	18·78	14·61
1885.....	19·80	22·95	16·89
1888.....	16·73	18·23	17·68
1891.....	20·42	19·49	17·42
1894.....	17·85	16·42	24·85
1897.....	21·40	20·17	16·97
1900.....	15·93	—	—
1903.....	—	—	—
Mean	19·12	19·49	19·15

General Mean..... 19·25

V. RAULIN.

Montfaucon d'Argonne, 18th June, 1903.

LAKE MOVEMENTS AND THUNDERSTORMS.

SEVERAL New Zealand newspapers recorded that the inland lake Taupo, on February 14th, rose one foot before a thunderstorm and fell again to its normal height after the storm was over. The lake, which has an area of 241 square miles, is the basin of an old volcanic crater. It is a pity that other observations are not available, for the rising and falling may have only been at one end of the lake, and not due in any way to electrical or subterranean causes. Still the matter seems to be worthy of investigation. D.C.B.

[The relation of the lake levels to meteorological conditions is, we understand, being carried out at present on Loch Ness, in Scotland, by Sir John Murray and his assistants, and we hope to be able, before very long, to publish some description of the methods used and the results which have been obtained.—ED. *S.M.M.*]

THE KEW OBSERVATORY.

THE members of the Council of the Royal Meteorological Society on Wednesday, June 8th, paid a visit to the Kew Observatory, on the invitation of Dr. R. T. Glazebrook, F.R.S. and Dr. C. Chree, F.R.S. Several ladies accompanied the party, and the afternoon being fine a very pleasant time was spent in inspecting the various departments, and in listening to the descriptions of the instruments courteously given by the members of the staff.

Kew Observatory is in the Old Deer Park, about 1,200 yards from Richmond Railway Station. The building, which stands on the site originally occupied by an old monastery, was erected by King George III., in 1769, for observing the transit of Venus. The late Mr. J. P. Gassiot, about 1871, put in trust with the Royal Society an endowment of £10,000 for the purposes of the Observatory, which had been for some time carried on by the British Association; and the management since that time has been in the hands of the Kew Committee appointed by the Royal Society. From 1900 the Observatory has formed part of the National Physical Laboratory, the headquarters of which, however, in 1902 were transferred to Bushy House, Teddington. Dr. C. Chree, F.R.S., is the Superintendent, and the staff includes Mr. T. W. Baker, the first assistant, and 15 others.

The Observatory since 1867 has been the central observing station of the Meteorological Office.

The self-recording magnetic instruments for showing the variations in the declination, the horizontal force component, and the vertical force component, as well as the barograph and the seismograph, are in a room in the basement. These all record photographically. The thermograph is placed on the north wall of the first floor, and the electrograph is close by on the west wall. The Beckley anemograph, for showing the direction and the velocity of the wind, is mounted above the dome, the recording apparatus being in a room underneath. A Dine's pressure tube anemometer is also placed close by. Two Campbell-Stoke's sunshine recorders are on the parapet of the roof.

In the garden to the south of the Observatory are placed the various out-door instruments, including the Beckley self-recording rain guage, and a Nipher rain guage.

Apart from the ordinary observatory work, the Kew Observatory is specially devoted to the examination and verification of meteorological and other instruments; and the visitors were much interested in seeing the methods employed and the apparatus used for this purpose. The great extent and variety of this important work will be gathered from the following list of instruments examined last year:—

Air-meters	...	...	24
Anemometers	...	...	14
Aneroids	...	...	86
Artificial Horizons	...	...	21
Barometers	...	...	298
Binoculars	...	...	1048
Compasses	...	...	9
Hydrometers	...	...	353
Inclinometers	...	...	8
Levels	...	...	16
Magnets	...	...	15
Milk Test Apparatus	...	...	89
Rain Gauges	...	...	67
Rain-measuring Glasses	...		131
Sextants	...	...	901
Sunshine Recorders	...	...	6
Telescopes	...	...	3180
Theodolites	...	...	23
Thermometers, Clinical	...		19393
,, Meteorological			2851
,, Special	...		389
Unifilars	...	...	5
Watches and Chronometers	...		458
Miscellaneous	...	...	35
Total	...		29,420

ROYAL METEOROLOGICAL SOCIETY.

THE final Meeting of the present session was held on the afternoon of Wednesday, June 15th, at the Society's Rooms, 70, Victoria-street, Westminster, Captain D. Wilson-Barker, President, in the chair. Mr. F. W. FitzSimons, F.Z.S., and Mr. G. W. Bernini Palmer were elected Fellows.

The Rev. C. F. Box gave an account of some curious "Effects of a Lightning Stroke at Earl's Fee, Bowers Gifford, Essex, April 13th, 1904." A thunderstorm occurred during the early morning hours, and at about 3 a.m. there was a blinding flash, lighting up the whole neighbourhood for miles around, followed immediately by a crashing explosion. One person stated that he saw what appeared to be a cylinder, and another person, a ball of fire, descend and then explode, "casting darts" in all directions. On careful examination in daylight it was found that in an oat field, which had recently been dredged, there were three distinct sets of holes ranging from nine inches down to about one inch in diameter. The holes, which were circular, diminished in size as they went downwards, and remained so on to the perfectly rounded ends at the bottom. Upon digging sectionally into the soil, which is stiff, yellow clay, it was found that the holes were "as clean cut as though bored with an auger."

Mr. W. Marriott said that the thunderstorm at Earl's Fee formed part of a series of thunderstorms which occurred over the south-eastern and eastern districts on the early morning of April 13th. The storm burst over the south coast at 2 a.m., and reached Lowestoft about 5 a.m., the rate of travel being about 50 miles an hour. Mr. Marriott showed some lantern slides illustrating various types of lightning flashes, and said that with moving cameras it was often found that there were several flashes on the plate following precisely similar courses. He pointed out that the flickering or repeating character of the lightning so frequently observed was really due to a succession of flashes following the same path. It might be that the three sets of holes mentioned by Mr. Box were caused by repeating lightning of three flashes with a slight distance between them. He was also of opinion that if the soil had been of a sandy nature instead of clay, the sand would have been fused and "fulgarites" formed.

Mr. R. Inwards said that it would have been interesting if a plaster cast of the holes had been taken.

Mr. A. Hands remarked that this was a type of case not often investigated, as attention was more frequently paid to buildings damaged by lightning. He believed that instances of damage by lightning were more numerous in Essex than in any other county except Yorkshire.

Mr. R. G. K. Lempfert, on behalf of Dr. W. N. Shaw, exhibited the records from the Dines sensitive barographs in London and at Oxshott during the thunderstorm on April 13th.

The President stated that he had recently seen a house which had

been struck by lighning in the neighbourhood of Greenhithe. The lightning had cut a clean hole through the tiles of the roof, and passing to the ground had gone out at the open door.

A paper by Mr. A. Lawrence Rotch, of the Blue Hill Observatory, U.S.A., describing "an Instrument for determining the true Direction and Velocity of the Wind at Sea," was, in the absence of the Author, read by the Secretary.

THE SIX MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—June, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	10·44	109	Arncliffe	31·86	119	Braemar	12·85	90
Tenterden	13·02	117	Hull	9·48	91	Aberdeen	14·93	112
Hartley Wintney	13·01	123	Newcastle.....	12·28	117	Cawdor	11·02	89
Hitchin	9·62	100	Seathwaite ...	65·01	112	Glencarron ...	43·06	107
Winslow	11·19	114	Cardiff	21·08	133	Dunrobin	14·52	110
Westley	9·90	96	Haverfordwest	22·08	124	Killarney ...	26·38	112
Brundall.....	9·95	98	Gogerddan ...	20·22	113	Waterford ...	21·06	125
Alderbury	15·19	130	Llandudno ...	13·06	109	Broadford.. ...	18·40	129
Ashburton	28·86	133	Dumfries	19·61	103	Carlow	15·99	109
Polapit Tamar ...	22·19	148	Lilliesleaf	16·29	128	Dublin	12·83	110
Stroud	14·01	121	Colmonell	18·11	96	Mullingar.....	18·11	114
Woolstaston	13·86	110	Glasgow	16·99	110	Ballinasloe ...	18·61	119
Boston	8·96	106	Inveraray	33·85	108	Clifden	41·04	119
Hesley Hall	9·39	107	Islay	22·87	120	Crossmolina ...	29·98	132
Derby.....	10·43	105	Mull	30·40	126	Seaforde	17·55	110
Bolton	16·75	100	Loch Leven ...	17·01	111	Londonderry..	17·09	99
Wetherby	14·43	141	Dundee	12·55	107	Omagh	20·34	123

June proved to be a dry month in almost all parts of the British Isles, the average deficiency of rainfall over England and Ireland being about one inch, and over Scotland about half-an-inch. A few stations on the west coast showed small excesses, but on the whole it was the driest June for several years; in the south-east of England certainly the driest since 1895. The rainfall for the year in the extreme east of England is no longer above the ten years' average employed for this Table, and excesses above 25 per cent. are confined to the south-west of England, the south of Ireland, and one or two scattered patches which are probably very small. The contrast with June, 1903, is marked, both as regards the rainfall for the month itself in the south of England, and the aggregate rainfall in most places. In Devonshire, however, the first half of 1904 has proved wetter than the first half of 1903. The number of rainy days appears to have been greater in June, 1904, than in the corresponding month of 1903, but this year there has been an unusual absence of thunderstorms.

RAINFALL AND TEMPERATURE, JUNE, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	·84	— 1·06	·26	14	6	76·7	30	43·1	4	0	0
II.	Tenterden ...	1·64	— ·55	·66	9	10	75·0	30	44·0	26	0	0
,,	Hartley Wintney ...	·79	— 1·16	·25	1	7	79·0	30	42·0	27, 28	0	0
III.	Hitchin	·86	— ·92	...	...	...	...	...	...	...	...	...
,,	Winslow (Addington) ...	·60	— 1·25	·23	14	8	79·0	30	39·0	28	0	0
IV.	Bury St. Edmunds (Westley)	·81	— 1·23	·28	14	6	75·0	14	40·0	26	0	...
,,	Brundall	·68	— 1·34	·25	14	9	75·6	14	39·8	13	0	0
V.	Alderbury ...	·87	— 1·10	·25	1	8	71·0	23, 30	41·0	27	0	...
,,	Winterborne Steepleton ...	1·31	...	·30	14	9	70·0	4	36·9	10	0	0
,,	Torquay (Cary Green) ...	1·11	...	·40	14	8	70·1	30	44·5	10	0	0
,,	Polapit Tamar [Launceston]	1·31	— 1·08	·42	14	12	69·2	4, 5	35·5	10	0	...
,,	Bath ...	1·46	...	·53	1	8	74·2	30	41·2	27	0	...
VI.	Stroud (Upfield) ...	1·18	— ·82	·48	14	9	78·0	30	47·0	3	0	...
,,	Church Stretton (Woolstaston)	1·17	— ·97	·40	1	11	72·0	29, 30	41·5	6	0	...
,,	Bromsgrove (Stoke Reformatory)	·61	— ·89	·33	1	6	75·0	30	35·0	26	0	...
VII.	Boston ...	1·55	— ·13	·45	2	7	77·0	30	41·0	27	0	...
,,	Bawtry (Hesley Hall) ...	·34	— 1·33	·12	9	5	77·0	29	34·0	28	0	...
,,	Derby (Midland Railway)...	·53	— 1·52	·27	24	7	80·0	29, 30	40·0	27	0	...
VIII.	Bolton (The Park) ...	1·42	— 2·18	·35	13	12	73·1	30	42·0	2	0	0
IX.	Wetherby (Ribston Hall) ...	1·57	— ·52	·40	26	10	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	2·20	— 1·53	·40	16	11	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	·75	— 1·22	·23	9	10	72·0	29	41·0	4	0	0
X.	Newcastle (Town Moor) ...	2·11	+ ·23	1·35	24	12	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	4·39	— 2·71	1·10	14	13	78·5	5	40·4	8	0	...
XI.	Cardiff (Ely)	1·45	— ·88	·67	14	8	...	...	...	...	...	...
,,	Haverfordwest (High St.)...	2·93	+ ·60	·90	12	10	72·6	6	40·5	22	0	0
,,	Aberystwith (Gogerddan)..	2·19	— ·45	·70	1	7	84·0	5	35·0	27	0	...
,,	Llandudno ...	1·93	— ·04	1·00	1	8	76·0	29	45·8	3, 28	0	...
XII.	Cargen [Dumfries] ...	2·36	— ·36	·72	24	9	77·2	5	40·0	27	0	...
XIII.	Edinburgh (Royal Observy.)	2·12	...	·73	1	12	72·8	30	41·3	28	0	0
XIV.	Colmonell	1·92	— ·75	·74	14	11	76·0	6	38·0	26, 27	0	...
XV.	Tighnabruaich ...	2·85	...	·78	14	12	71·0	5	40·0	26, 27	0	0
,,	Mull (Quinish) ...	3·84	+ ·41	·62	13	15	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	1·77	— ·61	·31	14, 25	9	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	·50	— 1·33	·10	13, 14	11	72·6	3	39·5	11	0	...
XVII.	Braemar ...	1·51	— ·82	·31	16	11	75·0	3	37·5	28	0	3
,,	Aberdeen (Cranford) ...	·91	— 1·23	·25	23	13	69·0	3	37·0	6	0	...
,,	Cawdor (Budgate)	1·50	— ·82	·78	1	12	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	5·97	+ ·23	2·31	16	16	73·0	30	39·6	28	0	...
,,	Bendamph ...	5·83	+ 1·93	1·86	16	15	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	1·28	— ·76	·30	1	12	65·0	15	38·5	28	0	...
,,	Castletown ...	1·22	...	·26	23	15	73·0	4, 15	33·0	27, 28	0	...
XX.	Killarney ...	2·23	— 1·41	·50	15	10	77·0	6, 7	43·0	10	0	...
,,	Waterford (Brook Lodge)...	2·52	— ·09	·84	12	8	69·0	5, 6	43·0	3	0	...
,,	Broadford (Hurdlestown) ...	2·01	— ·40	·28	30	14	74·0	6	45·0	16	0	...
XXI.	Carlow (Browne's Hill) ...	1·40	— ·87	·30	14	10	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·08	— ·84	·25	9	10	72·0	30	45·1	27	0	0
XXII.	Ballinasloe	1·65	— 1·00	·61	14	14	77·0	5	42·0	23	0	...
,,	Clifden (Kylemore House)..	5·48	+ ·05	1·55	14	13	...	...	...	...	...	...
XXIII.	Seaforde ...	2·18	— ·38	·66	9	12	86·0	4, 5	43·0	1, 2	0	0
,,	Londonderry (Creggan Res.)	1·10	— 2·04	·34	14	9	...	...	...	...	...	...
,,	Omagh (Edenfel) ...	1·85	— 1·16	·56	14	11	78·0	5	35·0	26	0	1

+ *Shows that the fall was above the average*; — *that it was below it.*

SUPPLEMENTARY RAINFALL, JUNE, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	·64	XI.	New Radnor, Ednol	1·07
,,	Sheppey, Leysdown	1·31	,,	Rhayader, Nantgwillt	2·06
,,	Hailsham	·98	,,	Lake Vyrnwy	1·80
,,	Crowborough	1·27	,,	Ruthin, Plâs Dràw.....	1·29
,,	Ryde, Beldornie Tower.....	·88	,,	Criccieth, Talarvor.....	1·32
,,	Emsworth, Redlands..... ...	1·25	,,	Anglesey, Lligwy	1·07
,,	Alton, Ashdell	·98	,,	Douglas, Woodville	1·65
,,	Newbury, Welford Park ...	·93	XII.	Stoneykirk, Ardwell House	2·19
III.	Harrow Weald	·90	,,	Dalry, Old Garroch	2·71
,,	Oxford, Magdalen College..	·75	,,	Langholm, Drove Road.....	3·84
,,	Banbury, Bloxham...	·56	,,	Moniaive, Maxwelton House	2·39
,,	Pitsford, Sedgebrook.....	·53	,,	Lilliesleaf, Riddell	2·73
,,	Huntingdon, Brampton.....	·61	XIII.	N. Esk Reservoir [Penicuick]	2·80
,,	Wisbech, Bank House	·52	XIV.	Maybole, Knockdon Farm..	1·80
IV.	Southend	1·12	,,	Glasgow, Queen's Park	1·35
,,	Colchester, Lexden.....	·87	XV.	Inveraray, Newtown.....	3·35
,,	Saffron Waldon, Newport...	1·05	,,	Ballachulish, Ardsheal	4·80
,,	Rendlesham Hall	·52	,,	Campbeltown, Redknowe...	1·34
,,	Swaffham	·67	,,	Islay, Eallabus	1·64
,,	Blakeney	·70	XVI.	Dollar	1·06
V.	Bishop's Cannings	1·00	,,	Balquhidder, Stronvar	4·57
,,	Ashburton, Druid House ...	1·75	,,	Coupar Angus Station	·86
,,	Okehampton, Oaklands.....	1·29	,,	Blair Atholl.....	1·97
,,	Hartland Abbey	1·12	,,	Montrose, Sunnyside.....	·53
,,	Lynmouth, Rock House ...	1·17	XVII.	Alford, Lynturk Manse ...	·95
,,	Probus, Lamellyn	1·93	,,	Keith, H.R.S..... ..	1·64
,,	Wellington, The Avenue ...	·88	XVIII.	Fearn, Lower Pitkerrie.....	·83
,,	North Cadbury Rectory ..	·70	,,	S. Uist, Askernish	2·58
VI.	Clifton, Pembroke Road ...	1·92	,,	Invergarry	3·61
,,	Moreton-in-Marsh, Longboro'	1·11	,,	Aviemore, Alvie Manse.....	1·42
,,	Ross, The Graig	·97	,,	Loch Ness, Drumnadrochit.	1·95
,,	Shifnal, Hatton Grange.....	·69	XIX.	Invershin	1·17
,,	Wem Rectory	1·02	,,	Altnaharra	...
,,	Cheadle, The Heath House.	·96	,,	Bettyhill	·95
,,	Coventry, Kingswood	·41	,,	Watten, H.R.S.	1·30
VII.	Market Overton	·58	XX.	Cork, Wellesley Terrace ...	2·17
,,	Market Rasen	·30	,,	Darrynane Abbey	5·28
,,	Worksop, Hodsock Priory..	·37	,,	Glenam [Clonmel]	3·02
VIII.	Neston, Hinderton.....	2·09	,,	Ballingarry, Hazelfort	1·49
,,	Southport, Hesketh Park...	1·12	,,	Miltown Malbay.....	1·68
,,	Chatburn, Middlewood	1·29	XXI.	Gorey, Courtown House ...	2·01
,,	Duddon Valley, Seathwaite Vic.	3·12	,,	Moynalty, Westland	...
IX.	Langsett Moor, Up. Midhope	·89	,,	Athlone, Twyford	1·72
,,	Baldersby.....	1·35	,,	Mullingar, Belvedere.....	1·34
,,	Scalby, Silverdale	1·00	XXII.	Woodlawn	1·50
,,	Ingleby Greenhow Vicarage	1·50	,,	Westport, Murrisk Abbey..	2·82
,,	Middleton, Mickleton	1·53	,,	Crossmolina, Enniscoe	3·02
X.	Beltingham	1·12	,,	Collooney, Markree Obsy...	1·85
,,	Bamburgh.....	2·12	XXIII.	Enniskillen, Portora	1·66
,,	Keswick, The Bank	2·10	,,	Warrenpoint	1·49
,,	Melmerby Rectory.....	1·74	,,	Banbridge, Milltown	1·41
XI.	Llanfrechfa Grange.....	1·50	,,	Belfast, Springfield	1·35
,,	Treherbert, Tyn-y-waun ...	2·86	,,	Bushmills, Dundarave	1·01
,,	Llandovery, Tonn	1·77	,,	Stewartstown	1·40
,,	Castle Malgwyn	2·33	,,	Killybegs	1·38
,,	Llandefaelog-fach	1·26	,,	Horn Head	1·04

METEOROLOGICAL NOTES ON JUNE, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm. R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The weather was somewhat cloudy and lacking in sunshine, but dry and generally fine. It was the driest June for nine years. The temp. kept at an uncomfortably low point at times, especially during the first week, and on only three days during the month did the max. exceed 75°. The duration of sunshine was 158°·7* hours, and of R 16·7 hours. Mean temp. 58°·9, or 1°·5 below the average. No TS8.

ABINGER HALL.—Very dry, with a good deal of cold N. and N.W. wind, and several slight frosts towards the end. Splendid hay-time and good crops.

TENTERDEN.—East wind in the first part damaged the fruit. There was a fair amount of sunshine, 230·5† hours, but only 8 days with max. temp. above 70°. TS on 6th.

CROWBOROUGH.—A beautiful summer month, with considerable sunshine and deficient R. Mean temp., 55°·6.

HARTLEY WINTNEY.—Persistent cold N. and N.E. wind and fitful sunshine marked the first fortnight. The second fortnight was exceedingly dry, and the last week summerlike. Ozone on 14 days with a mean of 2·1. Hay crops good.

PITSFORD.—A beautifully fine warm month. R 1·42 in. below the average. Mean temp., 56°8.

COLCHESTER.—Cool and very dry, with many bright days, and excellent weather for hay harvest.

BLAKENEY.—R 1·17 in. below the average of 10 years. Heavy storms occurred some few miles away, but none reached here, although T was often heard.

TORQUAY, CARY GREEN.—R 1·09 in. below the average. Duration of sunshine, 240·1 hours, or 9·5* hours above the average. Mean temp. 57°·7, or 1·0 below the average. Mean amount of ozone, 5°·1.

WELLINGTON.—Pleasant weather, with very little R and much bright sunshine, though the temp. was rather low, only 5 days having a max. of 70° or above. R an inch below the normal.

NORTH CADBURY RECTORY.—Very dry but not hot, with many rather low maxima and some cold nights. Hardly a day without very perceptible wind.

CLIFTON.—After a very wet and cold day on the 1st, it was fine on the whole till the 12th. Thereafter alternate rainy and fine spells of a few days continued until the end. Fine and warm from 27th to 30th.

ROSS.—The R was less than half the average, and there were no days with heavy falls, and only three with more than ·07 in. The mean temp. was rather more than a degree below the average. The nights were frequently very cold, and on no day did the max. reach 80°.

WORKSOP.—The driest June for at least 30 years, except 1887.

BOLTON.—The driest June since 1889. The duration of sunshine was 179·8 hours, or 19·0 hours above the average. Mean temp. 53°·8, or 2°·2 below the average, and the lowest since 1892. T and L on 24th. Much of the hay had already been secured in fine condition by the end of the month, and cereals promise to yield good crops.

SOUTHPORT.—Exceptionally windy; dry, but rather cool. Mean temp. 1°·2 below the average. Duration of sunshine 9* hours above the average. R 1·10 in. below the average.

HULL.—Generally mild, with some bright warm days. Cold nights until 12th, but afterwards warm. T and L on 26th.

* Campbell-Stokes. † Jordan

LLANDOVERY.—A fine month, but cool, and very similar to June, 1903, the mean temp., 56°·4, being the same. Grass crops were remarkably good and well harvested.

HAVERFORDWEST.—Fine and warm, but without any high temp. From 12th to 17th was wet and stormy, with a strong gale beginning on the 14th, and doing some damage. Duration of sunshine, 230·6* hours. No TSS. Crops of all kinds looking well, but backward.

DOUGLAS.—The fourth successive month of persistently low temp., but sunshine was not deficient as in the three previous months. Spring flowers were in bloom at the month's end. Mean temp. 0°·8 below the average.

SCOTLAND.

CARGEN [DUMFRIES].—Fine genial weather during the first half, but the latter part was wet, cold and squally. T and L on 24th. Great promise of fruit and farm crops.

LANGHOLM.—The R was ·48 in. above the average of 28 years, and 1·57 in. above that for June, 1903. TS on 24th.

MAXWELTON HOUSE.—Fine as a whole. R ·46 in. below the average. Mean temp. 57°, being equal to the average.

LILLIESLEAF, RIDDELL.—R ·76 in. above the average. The weather was quite satisfactory for agricultural purposes, and there was grass in abundance.

INVERARAY.—Both the beginning and end were fine and warm, but the season was somewhat late.

MULL, QUINISH.—Abundant sunshine and an excellent prospect for fruit and crops. The week beginning on 13th was exceptionally stormy.

COUPAR ANGUS.—The month opened bright and warm, but cold and stormy N.W. winds, more like March than June, predominated till 27th, and the month closed bright and warm.

LYNTURK MANSE.—The first instance in 4 years of a month with less than an inch of R.

DRUMNADROCHIT.—R ·18 in., and rainy days 1, below the average of 18 years.

BETTYHILL.—Bright dry weather with scarcely any R.

WATTEN.—Dry and fine, though often cloudy and windy.

CASTLETOWN.—The first twelve days were very dry, with light wind and high bar. Strong westerly winds to 22nd with R and overcast skies. The latter part was changeable, but cold N. and S.E. winds. Slight frost on 28th.

IRELAND.

CORK.—Mean temp. 4°·3, and R ·62 in., below the average. Prevailing winds E. and W.

DARRYNANE ABBEY.—R 55 per cent. above the average, the excess being due entirely to an exceptional fall of 2·79 in. on 28th, most of which fell after 8 p.m. A gale on 15th and 16th damaged the potato crops in exposed places. On the whole it was a fairly fine month, with some very fine and hot days, especially in the first half.

BROADFORD, HURDLESTOWN.—A favourable June. Crops of all kinds doing well.

MILTOWN MALBAY.—An ungenial June. Rather cold with dry winds. Little R, though 15 rainy days. Only two real summer days.

DUBLIN.—A favourable month, with average temp. by day and night. Bright sunshine 242·3 hours, being 45 hours above the Phœnix Park average.

BANBRIDGE.—R ·89 in. below the average of 40 years.

BELFAST.—A most encouraging June, the finest since 1893, and the finest month since March, 1900. Crops promising excellently.

OMAGH.—It is long since there has been so summerlike and agreeable a June, or one in which the resulting softness of foliage and profusion of flowers have lent more beauty to the landscape. Early fruits were most abundant, and later ones promise equally well.

Climatological Table for the British Empire, January, 1904.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	55·3	13	25·1	1	44·1	34·8	37·8	93	65·1	19·8	2·33	22	7·8
Malta	69·1	23	42·1	21	59·7	48·8	47·5	81	107·4	39·0	3·63	18	5·9
Lagos, W. Africa	89·0	sev.	66·0	10	87·0	74·1	74·2	77	136·0	63·0	1·85	3	3·7
Cape Town	100·5	23	50·6	27	78·5	60·0	56·8	65	...	...	·34	4	1·6
Durban, Natal	94·5	15	62·8	31	85·4	68·8	...	...	148·3	...	4·11	14	6·1
Mauritius	89·3	8	67·6	19	85·4	71·7	68·8	75	153·0	64·0	3·36	23	6·8
Calcutta	83·4	18	48·6	8	78·3	54·3	53·4	64	136·2	41·1	·00	0	0·7
Bombay	87·9	7	62·3	19	83·7	69·1	64·7	69	136·4	56·9	·00	0	1·0
Madras	84·8	27	61·8	31	83·0	69·2	67·5	78	138·1	56·5	1·00	3	4·0
Kodaikanal	72·1	31	39·9	7	62·1	46·2	38·4	61	135·4	28·0	3·39	4	4·8
Colombo, Ceylon	91·0	7	68·3	31	83·5	72·0	68·9	78	157·7	67·0	5·74	16	6·4
Hongkong	74·9	14	44·9	20	64·9	55·4	50·9	72	126·1	...	·12	2	4·9
Melbourne	94·2	9	48·1	27	74·9	57·0	54·8	72	151·2	41·0	5·68	14	5·6
Adelaide	100·3	8	46·9	21	81·3	58·8	50·9	51	154·5	37·9	2·53	8	3·2
Coolgardie	107·2	16	48·6	4	92·3	60·4	50·0	39	174·6	46·5	·01	1	0·8
Sydney	96·8	26	58·5	28	77·4	64·6	59·8	67	134·9	45·0	1·93	17	4·8
Wellington	82·3	21	46·1	9	71·1	54·0	51·9	50	155·0	41·0	1·50	10	5·1
Auckland	78·0	12	49·5	9	73·2	59·7	59·3	78	148·0	46·0	·82	8	5·0
Jamaica, Negril Point	87·8	22	63·8	7	84·9	69·1	67·5	74	...	...	1·42	5	...
Trinidad	89·0	16	62·0	22	85·2	67·9	70·1	80	160·0	61·0	3·00	17	...
Grenada	84·8	1	69·6	24	81·3	71·9	70·0	74	150·0	...	5·62	22	3·2
Toronto	40·2	22	−15·1	4	24·3	7·6	15·5	85	59·8	−18·2	2·39	18	7·0
Fredericton	41·9	14	−27·5	4	19·1	−3·6	−4·5	59	...	...	3·40	9	6·4
Winnipeg	36·1	7	42·0	24	7·4	−13·4	...	...	...	...	·17	4	3·7
Victoria, B.C.	55·1	12	27·7	19	45·0	37·6	...	...	...	...	4·32	23	8·8
Dawson	20·0	6	−57·8	14	−16·1	−26·4	...	...	...	...	·82	8	5·8

MALTA.—Mean temp. of air 54°·1 or 0°·9 above, mean hourly velocity of wind 10·5 or 0·7 below, averages. Mean temp. of sea 60°·0. T88 on 26th.

Mauritius.—Mean temp. of air 1°·3, dew point 1°·3, and R 3·74 in., below averages. Mean hourly velocity of wind 10·4 miles, or 0·7 below average; mean direction E.

MADRAS.—Bright sunshine 209·2 hours.

KODAIKANAL.—Mean temp. of air 52°·4. Mean velocity of wind 317 miles per day. Bright sunshine 185·8 hours.

COLOMBO, CEYLON.—Mean temp. of air 77°·6 or 1°·5 below, of dew point 1°·1 below, and R 5·74 in. or 2·17 in. above, averages. Mean hourly velocity of wind 11·3 miles, prevailing direction N. T88 on 8 days.

HONGKONG.—Mean temp. of air 59°·5. Bright sunshine 185·2 hours Mean hourly velocity of wind 13·8 miles; mean direction E. by N.

Adelaide.—Mean temp. of air 4°·1 below, and R 1·39 in. above, average.

Sydney.—Mean temp. of air 0°·5, humidity 4 %, and R 1·63 in. below, averages.

Wellington.—Mean temp. 3°·0 above, and R ·91 in. below, averages; prevailing winds, N.W. and S.

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THE WETTEST PLACE IN WALES,

With some Remarks on the Rainfall of the Year 1903.

By J. R. Gethin-Jones, Deganwy, Llandudno.

On looking at a good physical map of the country it is natural to expect that the wettest part of Wales would be found in the Snowdon district, and according to my investigations I find it to be on the eastern side of this mountain at 2500 feet elevation, near Glaslyn Lake. Although the records show, so far, that Snowdon will likely prove to be the wettest spot in the British Isles, I must, owing to the shortness of the period of investigation, apply the phrase, the "wettest spot," to Wales only for the present.

Having been born and lived all my life in Snowdonia, and always taken a deep interest in the physiography of my native surroundings, I saw in the great advancement of electrical science during recent years the possibility of utilizing the natural forces on the Snowdonian range. In order to get a proper idea of the amount of water available, I fixed rain gauges at several places on the range where I thought it would be most suitable to produce a cheap and large constant supply of power. There was another important point which always impressed me—viz., the desirability of knowing the actual rainfall in the heart of this interesting mountain, the surroundings and contour of which appeared exceptionally favourable to produce a high precipitation.

Having often read that certain places in Cumberland recorded the highest rainfall in the British Isles, being nearly double the highest recorded in Wales, and on comparing the surroundings and contour of Snowdon with those of Sca Fell and the Stye, in Cumberland, the more I studied the maps, the more convinced I became that the eastern side of Snowdon—called Cwm Llydaw—ought theoretically to prove as wet as The Stye. As I had previously observed at other places on the range that the greatest rainfall occurs between half-a-mile and a mile from the summit of the hills in line with the most prevalent moisture-bearing winds—the S.W.—on its sheltered side, I fixed a rain gauge of large capacity at a place in Cwm Llydaw called Glaslyn, situated one mile N.E. and 1000 feet below the

summit, in order to record the effect of the maximum condensation on the prevailing wind after passing the highest point.

On examining a good map, such as the one-inch Ordnance Map, it will also be seen that the cwm forming the eastern side of Snowdon is surrounded by ridges over 3000 feet in average height, in the form of a horse shoe, with the outlet or mouth facing the east, or the driest point. The contour of this cwm therefore acts as the sheltered side for the wind blowing from *all the wettest points*—viz., S. by W. to N. Thus the general effect of the condensed moisture, after passing over the ridges, meets in a focus at this cwm, accompanying rainstorms from all the wet points and all wind velocities except (according to my observations on the range) the very high velocities, during the prevalence of which the heaviest precipitation is carried forward a few miles beyond its base. The rule I always find at Snowdon and other places is, that the greater the wind velocity, the further away from the summit will the greatest precipitation take place; but as the frequency of rain with very high wind is small compared to the rest, the great bulk of the Snowdon condensation falls on its own slopes.

Besides the favourable contour of Cwm Llydaw, it will also be seen on the map that Snowdon is situated not only near the western sea coast with steep slopes, but that there are five comparatively low level valleys radiating from its base towards the sea and the wet points, along which the lower strata of the atmosphere is conveyed direct to its base under the most favourable conditions to retain moisture, and is then carried up *steep* slopes and over ridges 3000 ft. high, with the result that the maximum contained moisture is suddenly condensed or the sea level conditions suddenly changed to the discharging point by a vertical lift of 3000 feet and precipitated in a short horizontal distance, which in the case of Snowdon is in the nearest area contained within the surrounding ridges—viz., Cwm Llydaw.

Everybody is aware of the great prevalence of mist at Snowdon, the cause of which can be assumed to be the same as that of rainfall. According to my general observations on the range, I find that the yearly rainfall at different places coincides very remarkably with the height of the mist line—that is, the lower the average elevation of the mist line, the higher will be the average rainfall, and *vice versa*.

Regarding the rainfall at the "Wettest place in Wales" for such a wet year as 1903, I am sorry to state that, owing to my being laid up at the end of 1902, when the gauges should have been emptied in readiness for 1903, and only myself knowing where to find them on the ground, I am unable to give the actual measurement for more than seven months of the year—viz., from May 21st to the end of December; but with the seven months' records and those of two other places in the vicinity where the conditions are most like those of Snowdon having a full year's record—viz., Oakley, Blaenau Fes-

tiniog, and Tynddol, Dolwyddelen—I will try to give an estimate for the whole year at the wettest spot.

The Glaslyn gauge (supposed to represent the wettest spot at Snowdon) is situated on a flat piece of ground, covered mainly with grass, one mile N.E. of the summit, near Glaslyn Lake, at 2500 feet elevation. It is 5 inches in diameter, with a long neck and special form in the lower part, so as to hold a large quantity, about 130 inches; sunk well into the ground to prevent the water from freezing. About half-a-mile S.E. of this gauge and 1000 feet lower down, near Llydaw Lake, there is another gauge of similar form. The Glaslyn gauge was fixed on September 1st, 1898, and the amount of rainfall measured from it and the surrounding gauges during the same period was as follows :—

Periods.	Snowdon.		Oakley. B. Festiniog 7 miles S.E. of Snowdon. 1100 ft.	Tynddol Dolwyddelen 5 miles E.S.E. of Snowdon. 600 feet.
	Glaslyn Gauge. 2500 feet.	Llydaw Gauge. 1450 feet.		
	inches.	inches.	inches.	inches.
From September 1st, 1898, to September 30th, 1899 = 13 successive months	217·33	193·36	109·69	119·42
Average per month	16·71	14·87	8·43	9·18
Average per 12 months	200·52	178·44	101·16	110·16
From March 1st, 1900, to December 31st, 1901 = 22 successive months	365·80	331·00	170·29	189·90
Average per month	16·60	15·00	7·73	8·63
Average per 12 months	199·20	180·00	92·76	103·56
Result of the two periods = 35 successive months	583·13	524·36	279·96	309·32
Average per month	16·16	14·98	8·0	8·83
Average per 12 months	199·92	179·76	96·0	106·0

It will be noticed that the first period covers one winter and one summer and the second period two summers and practically one winter. The other gauges on Snowdon are omitted owing to unavoidable gaps in the Glaslyn records.

Previous to 1902 the average annual rainfall at Oakley for a long period was about 94 inches, and at Tynddol about 100 inches. On this basis, the average at Glaslyn for a long period would therefore be about 190 inches a year.

The actual rainfall measured at Glaslyn and Llydaw for the seven months, May to December, 1903, was as follows :—

Intervals.	Glaslyn gauge. inches.	Llydaw gauge. inches.
From Sept. 30th, 1902, to May 21st, 1903	*Full, water emptied*	131·34
May 21st, 1903, to Sept. 8th, 1903	60·10	48·30
Sept. 9th, ,, ...	5·30	...
,, 11th, ,, ...	4·12	8·46
Oct. 23rd, ,, ...	30·20	26·60
Jan. 1st, 1904	44·20	37·10
Total for 7 months	143·90	120·46
Total for 15 months (Sep. 30, '02, to Jan. 1, '04)	300·00 (estimate)	251·80 (actual)
Equal for 12 months	240·00	200·40

The rainfall for the last three months of 1902 was about the average, but for the first five months of 1903 it was greatly above the average, so according to this, the total at Glaslyn for the twelve months of 1903 would be considerably above 240 inches.

According to the rainfall at Tynddol for the first 5 months of 1903—equal to 58·55 in.—and the 35 months Glaslyn ratio, the amount at Glaslyn for the same 5 months comes to 110 inches, which with the actual fall of 143·9 in. for the 7 months, makes 254 inches for the whole year at Glaslyn, and according to the same calculation and applying the ratio of Oakley, the total at Glaslyn for the year comes to 246 inches. Also, as the rainfall for 1903 was about 35 per cent. above the average on the whole range, and the average at Glaslyn for a long period is about 190 inches, the net result from the above different estimates gives the rainfall at the wettest spot in Wales for 1903 as at least 250 inches. If this figure is right it seems, as far as I know, to be above the highest ever previously recorded in the British Isles and in Europe. The previous highest was at The Stye, in Cumberland, being 243·98 in. in 1872.

During the autumn of last year I was fortunate to be at Cwm Llydaw, when I experienced very remarkable weather and took the opportunity during the most stormy time to watch the different phenomena.

During a heavy rainstorm, on August 14th, I measured the rate at which the rain fell as ·60 in. per hour, at Llydaw Lake, and higher up, at Glaslyn, as ·75 in. per hour. Considering that it was an ordinary cyclonic rain, this figure seems to be exceptionally high, also the raindrops appeared to me to be of larger size at Glaslyn than those lower down from the effect of their dropping on the lake and the bubbles left behind, giving an appearance as if the water was boiling, the sound from which—a high tone—could be heard quite distinct from that of the wind and the surrounding waterfalls.

When the wind blows over the ridges, the direction of it in the cwm below is very changeable; sometimes it would be quite calm, then sudden squalls, and forming whirlwinds, the track of which could be easily followed on the lakes, especially that of Llydaw; sometimes the parallel vertical rain columns could be seen travelling in reverse directions as if in a circle or following the contour of the cwm, and when the rain would be very thick and during the passing of the whirlwinds there was a tendency for the vertical columns to get closer and form a "solid" waterspout.

On September 9th I noticed that a waterspout had actually been formed during the previous night and burst on the steep slope below Llydaw Lake. It had excavated the ground in a semicircular form to a depth of about 3 feet—rock and boulder bottom—and measuring about 20 feet across, and had carried the material about a quarter of a mile down the hill side. Until lately, I had always been under the impression that such waterspouts were formed above the ridges or among the clouds, especially as the term "cloud-burst" implied something of that nature; but from my observations in Snowdonia, it seems to me that they are formed near the ground and always in the space *below* the ridges over which the wind blows at the time, being the sheltered side, and in places where the ground is in a concave form and the rain very thick; under these conditions, the raindrops are whirled round with the air and come in contact with each other forming a thin water column, and in further travelling through thick rain the whirling draws more rain in contact with the column and therefore grows larger in diameter and length until it has attained a size by which its weight overcomes that of the centrifugal power and then the whole water falls in line with the column, or following the vacuum created in dropping, which I find it *always* does, on a *single spot* a few yards in diameter, and does not burst or get spread about by the wind like a "solid" mass of water thrown out of a bucket during wind from a great height.

While treating on the wettest spot in Wales, and bearing in mind that the most rainy part of England has been so well explored, it seems to me a great pity that the real amount and the position of the highest rainfall in Scotland and Ireland is still unknown, so that it cannot be compared with that of England and Wales. Considering that so much interest is taken in ascertaining the extreme limit of certain things in nature—especially in our own country—and the cheapness and simplicity of work of this kind compared with other scientific explorations, I wish to suggest that something in the nature of a national scientific competition be undertaken by societies or individuals of each of the constituent nations, to ascertain how the countries stand in this matter, and find out the exact place where the greatest number of favourable physical features exist to produce the highest rainfall. It is quite possible that with further exploration in England and Wales, a spot could be found with a higher average than the present records show. Scotland is already

proud of possessing the highest mountain ; Ireland the largest lake ; England the largest river ; and, in my opinion, Wales the finest scenery. The claim of possessing the wettest spot is so far held by England ; but, as a Welshman, I feel with pleasure and am very confident—on scientific grounds—that with further time, Wales will be acknowledged to beat England by at least 20 inches a year. In regard to Ireland the position is rather peculiar. It is generally a wet country, yet one seldom hears of a rainfall exceeding 100 inches a year. Whatever view people take on Irish questions, I am sure that Ireland in this respect is not treated fairly, and it is a question that ought to be solved at once. There are several heights in Ireland over 3,000 ft.,, and some are situated on the very edge of the Atlantic, viz., Brandon Hill, Kerry, the surroundings of which, apart from its height, seem favourable to produce as high a rainfall as that of Snowdon and The Stye, with a good chance to claim the highest in the British Isles.

Regarding Scotland, the records at the summit of Ben Nevis are, and ought to be, very high ; but I cannot see how the real measurement of moisture at such a high elevation can be accurately gauged, as a large proportion of the moisture must fall in the form of dry snow, which during windy weather—so prevalent at the *summit*—must be mixed with the drifted snow-dust to a height above that of the rain gauge, and even the Observatory itself, and the drift must therefore be collected with the actual snowfall.

If the record at the summit of Ben Nevis represents the true amount of precipitation there—which is practically the same as that of The Stye—viz., about 170 inches, and as the recorded figures at the summit of Scafell, Great Gable and Great End are only half that of The Stye, with the latter place lying to the N. and on the sheltered side of these heights, it seems to me that the sheltered corrie lying to the north of Ben Nevis ought to record considerably over 300 inches, or that the present record at the summit does not represent the true figure. For this reason, I think the records of the wettest spots ought to be taken in the corries where the rainfall is likely to be not only higher, but also more accurately measured.

There are of course very many places in the Western Highlands possessing "points" favourable to the production of high rainfall, especially the Loch Coruisk Valley, Isle of Skye ; the conditions at this place, at the far end of the corrie, look almost ideal to produce the highest rainfall possible for this latitude. Considering the small expense, compared with other explorations, and the addition to our knowledge, to obtain such interesting facts about our own country, I venture to ask, is there not some Scotsman or Irishman who would take this matter in hand and co-operate with English and Welshmen to find out in a thorough and scientific manner which part of the United Kingdom can claim the notoriety of possessing the wettest spot ?

BRITISH RAINFALL, 1903.

We cannot, of course, profess to give an impartial review of one of our own publications, but there is no reason why the issue of the annual volume* dealing with the rainfall of the British Isles should not be recorded in these pages. The volume now appears under its present title for the forty-third time, but it has grown from a slim pamphlet of 18 pp. to a solid bound book of 368 pp. illustrated with 10 plates and 8 maps and diagrams in the text. The first volume dealt with "about 500 stations," the latest with "nearly 4000." The volume is not published as early as we could wish. This is mainly because a few observers whose records we would be most reluctant to omit cannot be induced to send in their observations ending in December until the month of June. The results cannot be generalised and discussed until they have all been received, checked and compared; hence the delay.

The new volume contains several new features. The two special articles deal with the daily rainfall of June, 1903 (and especially with the three remarkable days from the 13th to the 15th), and with the three wettest years of British rainfall, viz., 1872, 1877 and 1903, of each of which there is a rainfall map. A new section on the duration of rainfall is introduced in Part. I. In Part II., in addition to all the old features, there are sections dealing with rainy spells, *i.e.*, periods of more than fourteen consecutive rainy days; with the number of rainy days; and with the intensity of rainfall, classifying the number of daily falls of different amount. The section on monthly rainfall has been made more systematic, and the maps of the relation of the actual monthly rainfall to the average have been greatly improved. A special feature is made of maps of the distribution of rainfall on the wettest days of the year. The number of records dealt with is 3829, which is 193 more than in 1902.

WIRELESS TELEGRAPHY AND METEOROLOGY.

We have great pleasure in recording the public-spirited enterprise of the *Daily Telegraph* in supplementing its usual weather reports by special telegrams from the Atlantic. In its issue of August 6th it states:—"We have arranged with the Marconi Wireless Telegraph Company and the Atlantic steamship companies to send us, from ships homeward bound, telegrams reporting the readings of barometer and thermometer, description of the weather, force of the wind and state of the sea, and from these data we believe it will become possible, in many cases, to give intimation of coming storms

* On the Distribution of Rain over the British Isles during the year 1903, as observed at nearly 4000 stations in Great Britain and Ireland. With articles upon various branches of Rainfall work. Compiled by Hugh Robert Mill. London: Edward Stanford, 1904.

that it would otherwise be absurd to attempt. . . . . We assert, meanwhile, and every meteorologist will bear us out, that whatever may be the value of existing predictions, it will be doubled when the system we inaugurate to-day is fully developed. At present, ships at sea cannot send messages to the land over more than an average of one hundred miles. This arises simply from the want of sufficiently powerful transmitting apparatus, for the same ships can receive messages for over two thousand miles. Improved equipments are being installed and the time is not far distant when we shall be in receipt of wireless telegrams from mid-Atlantic, and when that day comes it will be rare that any great storm shall rush across these storm-swept islands of which we have not as full notice as can possibly be given."

We trust that the proprietors of the *Daily Telegraph* will not forget that these important telegrams from the Atlantic are of value only in connection with the information received daily by the Meteorological Office from the ordinary reporting stations and that it is at the Meteorological Office alone that they can be utilized and raised above the level of interesting items of information. If published in the newspaper without co-ordination, they will, we fear, prove no more valuable than the *New York Herald* storm warnings of years ago.

A HOT DAY IN AUGUST, 1904.

DURING the morning and afternoon of August 4th, the hottest day of 1904 up to August 15th, hourly readings were made of temperature and humidity on the Glaisher screen at Camden Square, with the following results :—

	Dry bulb.	Wet bulb.	Shade Max.	Relative Humidity.
9 a.m.	80·2	68·4	80·2	51
10 a.m.	84·8	70·2	84·8	44
11 a.m.	87·6	72·2	88·1	43
Noon	88·3	72·0	89·2	41
1 p.m.	90·1	73·0	90·2	39
2 p.m.	85·5	70·1	91·0	42
3 p.m.	82·2	69·0	91·0	47
4 p.m.	78·7	67·0	91·0	51
5 p.m.	74·0	66·2	91·0	63
9 p.m.	65·8	63·6	91·0	87

Heavy clouds gathered at about 3 p.m., and ·14 in. of rain fell between 5.30 and 7 p.m., with some distant thunder and lightning. It will be observed that the maximum temperature of 91°·0 occurred between 1 and 2 p.m. The minimum temperature of the preceding night was 59°·2, that of the succeeding night 61°·9. The duration of sunshine on the 4th was 7·5 hours, and the amount of evaporation from a freely exposed water-surface ·16 in.

THE YORKSHIRE THUNDERSTORM OF JULY 24th.

IN case you should not receive them from elsewhere, I venture to enclose the accounts published in the Huddersfield papers of the exceptional storm of Sunday evening last. My own station, about four miles from the centre of Huddersfield in a S.W. direction, was outside the worst of it, and there was nothing more than an ordinary heavy thunderstorm, except from 8.41 to 8.51 p.m. (for which see Note 4.) Mr. Woodhead, of Slaithwaite, (see newspaper report) is interested in meteorology and keeps a careful record, and he might be able to give you more information as he was in the thick of it. I enclose a few notes, however, which may be of interest.

CHARLES L. BROOK.

(1) Saturday, July 23rd.—Slight TSS all afternoon; heavy rain at Harewood Lodge from 11.56 a.m. to 0.15 p.m.; ·28 in. in 19 min. Rainfall for 24 hours ending 9 a.m. on 24th: Harewood Lodge, ·82 in.; Royd Edge (about) 1·00 in.

(2) Sunday, July 24th.—On this afternoon I several times noticed that currents of air were moving in two or three different directions at the same time; the upper current from S.S.W. faster than the lower and more intermittent currents, which were from N.E. to S.E. Little rain, however, fell till 7 p.m.

(3) At 7 p.m. commenced a prolonged and at times severe TS, which lasted till 11.30 p.m., during which time there fell at Harewood Lodge 1·19 in. and at Royd Edge ·64 in. There was nothing exceptional here in the T and L, but I noticed that to the N. and N.E. some of the flashes were high up, of long duration, and reddish orange in colour; often only the glare from behind the lowest layer of clouds could be seen.

(4) The only really exceptional rainfall was from 8.41 p.m. to 8.51 p.m., when ·53 in. fell in ten minutes. At 8.44 p.m. the wind rose very suddenly from the N.W. and blew with almost hurricane force for one or two minutes, during which time the downpour was so excessive that I have little doubt the rate of fall was double that mentioned above. The wind veered through N. to N.N.E. and it was quite calm before 9 p.m. This was the most sudden and severe squall I recollect and for a few moments I thought some of the trees would go. The barometer did not vary more than ·005 during the squall.

(5) The only other rainfall I have recorded which exceeds this was on June 26th, 1895, when 1·13 in. fell in 25 minutes with large hailstones.

(6) Total Rainfall, 24 hours ending 9 a.m. on July 25th:—

Royd Edge ..... ·85 in. (about). ⅔ mile S.W. of Harewood Lodge.
Harewood Lodge 1·41 in.
Hudd. Cemetery 3·80 in. about 4 miles N.N.E. of Harewood Lodge.
Slaithwaite ..... 3·97 in. about 3 miles N.W. of Harewood Lodge.

Harewood Lodge, Meltham, July 27th, 1904. C. L. B.

THE very heavy rainfall on Sunday, July 24th, is, I think, worthy of record in your Magazine.

The total fall for the 24 hours commencing 9 a.m. on that day was 3·97 inches. A fairly heavy thunderstorm commenced about 6 p.m. with one or two very slight showers of rain. Suddenly at 8.10 p.m. it commenced to rain in torrents and continued exactly an hour; the amount of rain during the 60 minutes was 2·36 inches. There was a fine interval of 35 minutes, and then more heavy rain for 1 hour and 20 minutes, when I measured a further 1·33 inches.

JAS. WOODHEAD.

Inglewood, Slaithwaite, Huddersfield, 1st August, 1904.

RAINFALL OF JULY 23-27.

DR. MILL, in his interesting letter to *The Times* on the thunderstorm of July 25th of the present year says:—"Few years pass without the occurrence of such a storm in the S.E. of England between the 23rd and 27th of July." My own experience, extending over a period of 25 years, is, that there are no other consecutive five days in the whole year which yield a larger aggregate of rain, and this mainly owing to the prevalence of thunder. Since 1880 I have gauged on these five days an aggregate of 17·07 inches, rain falling on 68 days. This gives an average of ·25 inch per rainy day. The analysis of these 68 days on which rain was observed shows that there was a fall of 2·00 in. on one day; 1·00 in. on one day; ·50 in. and more on eight days; and ·25 in. and more on fifteen days. On the other 43 days the fall was inconsiderable. The amount gauged last year and this on these five days was almost identical, being 2·22 in. last year against 2·30 in. this year. Thunderstorms occurred on 25th in 1901; and on 27th in 1901 and 1904; and thunder was in evidence in several other years, though no actual storm passed over my station.

C. WIGAN HARVEY.

Throcking Rectory, Buntingford, Herts, August 1, 1904.

The following is the portion of the letter referred to above dealing with the storm of July 25th:—

"The prolonged period of dry weather terminated yesterday with a fine example of a summer thunderstorm. Few years pass without the occurrence of such a storm in the south-east of England between the 23rd and 27th of July; but our knowledge of the distribution of the accompanying heavy rain is still very unsatisfactory. The rainfall day terminating at 9 o'clock this morning brought a fall of 1·71 in. of rain in this locality. In the southern suburbs I hear that not one-third of this amount fell. Perhaps in some districts much more may have been precipitated.

"Speaking for Camden Square alone, yesterday was wetter than any day in last year, and the amount of rain has only been exceeded

in one day five times since the record began in 1858. Those occasions were—July 25, 1867, with 1·82 in.; April 10, 1878, with 2·56 in.; June 23, 1878, with 3·28 in:; December 26, 1886, with 1·82 in.; and July 25, 1901, with 2·85 in. It is a curious point that three out of these six occasions should happen to have been July 25.

"Several gentle showers during the forenoon and afternoon of yesterday yielded ·20 in.; the thunderstorm from 6.45 to 7.30 brought down ·99 in. (of which ·40 in. fell in ten minutes); between 9 and 11 p.m. ·50 in. fell, and a slight shower some time after midnight brought the total for the day up to 1·71 in.

"The capricious local distribution of such heavy rains makes it desirable that their occurrence in such a densely-peopled area as London should be closely studied, and at present this is impossible owing to the large tracts of town which are unprovided with a rain gauge.

HUGH ROBERT MILL."

62, Camden Square, N.W., 26th July, 1904.

THE RAINFALL OF JULY 25th.

WE have received a large amount of correspondence on this subject, and could easily have filled this issue of the Magazine with letters from most parts of the country. The thunderstorm was a typical one—just the sort of storm that one expects to encounter towards the end of July; but it was in no way exceptionally severe. It is interesting to notice that while no case of rainfall exceeding 2·62 in. was reported, there are several instances of it being the heaviest fall experienced by observers. We quote a few of the more striking letters and refer to the Remarks on pp. 138–139 for others.

The following are the amounts for July 25th observed in London, the first name in each case is that of the Metropolitan Borough in which the station is situated :—

FULHAM	Edith Road, West Kensington	·80 in.
BATTERSEA	Battersea Park	·78 ,,
WOOLWICH	Court Road, Eltham	1·40 ,,
LAMBETH	Denmark Hill	·92 ,,
HAMPSTEAD	Burrard Road, West Hampstead	2·24 ,,
ST. PANCRAS	Camden Square	1·71 ,,
POPLAR	Old Ford	1·13 ,,

It will interest you to know that the rainfall here from 1 p.m. on 25th to 10 a.m. on 26th was 2·45 in.; ·22 in. fell afterwards before the rain ceased. This is by far the heaviest rainfall I have ever recorded. Of the 2 45 in., ·53 in. fell in less than an hour during a thunderstorm.

HERTFORD.

Ragley Hall, Alcester, 27th July, 1904.

On the 25th of July we had 2·35 in. of rain in a thunderstorm, the largest amount I have registered since beginning in 1895. Unluckily I was on my holiday, and, as often happens, missed the opportunity of detailed observation of an extreme fall.

R. P. DANSEY.

Church Stretton, 2nd August, 1904.

It may, perhaps, interest you to know that the rainfall here on the 25th inst. was 2·13 in.; of this, 1·05 in. fell between 1 p.m. and 7 p.m. and the remainder during the night.

H. TRETHEWY.

Hatton Vicarage, Warwick, 27th July, 1904.

I registered 1·70 in. rain at 9 a.m. to-day. It all fell after 9 p.m. yesterday.

E. T. DOWSON.

Geldeston, Beccles, July 26th, 1904.

Heavy distant thunder and lightning to the E., N. and S. of us last evening from 6.15 to 9.30. The storm did not come over the village. Rain began to fall at 6.10; by 7 o'clock ·07 in. had fallen, by 9 o'clock ·42 in., and at 6.10 this morning 1·45 in. was registered for the 12 hours.

WILLIAM HALL.

Swerford, Oxford, 26th July, 1904.

The heavy rain measured on the morning of the 26th began at 4 p.m. of the 25th and was over before 8 a.m. of 26th, so fell in 16 hours. About an hour after commencement a sharp thunderstorm began, and lasted an hour or two in the closest proximity to this place; the interval between flash and clap being repeatedly almost nil. The total amount of rain was 1·41 in.

Heavy rain fell all around, but I think the amount here was in excess of most parts near.

E. HILL.

The Rectory, Cockfield, Bury St. Edmunds.

EXTREMES OF TEMPERATURE IN JULY.

THE following newspaper extract and letter present a contrast in temperature, rarely if ever recorded before in the British Isles:—

"A JULY FROST IN SUTHERLANDSHIRE. — A correspondent, writing from Thurso, on Tuesday, July 19th, says:—This morning the north coast of Sutherland was visited by the severest frost experienced for a great number of years. In many cases the potato crop is done. Along the Strathnaver settlement the frost was most severe. The potato crop there was cut down on the 28th June, and was only beginning to recover. This second attack, which is fully more severe than that of the 28th June, means complete ruin to the

potato crop there this season. The loss will be a severe one to the settlers."—*Scotsman.*

THE maximum shade temperature recorded here yesterday (Sunday, July 17th) was 91° F., as registered by a thermometer certified at Kew Observatory, and placed in a Stevenson-pattern screen. The day was exceptionally clear, with an almost entire absence of wind until after sunset, when a brisk N.E. breeze sprang up.

This is the highest temperature recorded here since July, 1900, when we had several days over 90°. The previous highest this year was 85·5° on Saturday, July 9th; and the absolute maximum reached since observations were started by me here in 1896, was 93° in June, 1897.

HAROLD E. FRIER.

Risegate, Hadley Road, New Barnet, July 18th, 1904.

The range of temperature between the Barnet maximum and the Strathnaver minimum must have exceeded sixty Fahrenheit degrees by a considerable amount, and although the two stations are separated by seven degrees of latitude, summer frosts are very rare phenomena indeed in the north of Scotland near sea-level.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

BALL LIGHTNING.

I HAVE been reading with much interest the correspondence respecting Ball Lightning in the *Meteorological Magazine*, and the note to the letter by Mr. D. W. Horner, induces me to write to you. As a child of about 12, I was in a house which was struck by lightning, and still distinctly remember seeing what appeared like a great ball of fire poised above my bird cages for a few seconds; my belief is that it was, as you say, the "subjective impression of some luminous phenomenon."

On that occasion the electricity behaved with its usual eccentricity, deserting the pipe down which it was travelling to make the circuit of a small box-room, where it twisted a wire bonnet into a strange shape, and riddled a cotton dress with small holes such as might be made with the glowing end of a match; it then returned to the pipe and travelled safely to the ground. I have always been puzzled to think why the large bird cages were spared and the small wire bonnet frame destroyed, neither being in the direct line of communication.

GERTRUDE ELLIOT.

Ardington House, Wantage, Berks, July 19th, 1904.

A WHIRLWIND.

In the *Daily Mail* of June 29th, appeared accounts of two Whirlwinds, one at Willesden Green, the other near Bristol, occurring on June 28th. I was not myself at home on that day, but from three eye-witnesses, one of whom was the very best person in the parish to give a report of such a thing, I learn that on that same day, at about 3.30 p.m., a whirlwind crossed the paddock in front of my Rectory, belonging to me, and whisked up a lot of hay just ready for carrying, took it up to a great height (200 ft. I should infer), and then let it fall in the Churchyard and on the tower top, 72 ft. from ground, and on Cadbury House roof beyond the Church. From the quantity which I myself saw afterwards on the tower top, and on the tower staircase, and spread about the Churchyard, which it had littered badly, I should judge that there must have been a large quantity carried up by the wind—perhaps a ton. The course of the whirlwind was roughly from N.W. to S.E.

H. A. BOYS.

North Cadbury Rectory, Somerset, July 26th, 1904.

AN OLD SEVERE WINTER.

Is this cutting from the *Dorset County Chronicle*, of 25th Jan., 1838, of any interest to you?

JAMES CROSS.

Bailie House, Wimborne.

"Poole, 24th Jan., 1838.—The weather we experienced for the fortnight ending on Saturday last was intensely cold. With many fluctuations, but generally increasing in intensity, the cold on Friday night was so excessive as hardly to have been parallelled in the recorded meteorology of the town. On Friday evening it was observed that large crystals of ice were spreading over the waters of the harbour, and on Saturday morning the whole of that vast body of tidal water comprised in the harbour was covered with a sheet of ice, varying from one to three inches in thickness. The freezing of this estuary of the sea, subject as it is to the motion of the tide, &c., has not before occurred for the last forty-nine years. Fortunately, a thaw commenced on the afternoon of Saturday, or a total interruption must have taken place in the navigation of the harbour. During the prevalence of the severe weather, immense numbers of wild fowl frequented the shores and neighbourhood of the harbour, and were shot in unprecedented quantities.

"Christchurch.—Such was the intensity of the frost last week, that the Christchurch Serpentine, alias the Stour, bordering on this town, was so completely frozen as safely to admit a very large concourse of persons of the town and neighbourhood to assemble on the ice on Friday last. Beauty and fashion promenaded on one part of the river; whilst a party was playing a most animated game of cricket on a distant part."

THE SEVEN MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—July, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	12·85	108	Arncliffe	34·26	108	Braemar	14·58	85
Tenterden	15·18	110	Hull	12·83	101	Aberdeen	16·25	102
Hartley Wintney	15·07	116	Newcastle.....	13·77	104	Cawdor	11·65	74
Hitchin	13·41	111	Seathwaite ...	73·52	110	Glencarron ...	45·44	96
Winslow	13·93	113	Cardiff	26·20	137	Dunrobin	15·66	98
Westley.....	12·41	94	Haverfordwest	24·03	114	Killarney ...	31·48	113
Brundall.....	11·80	91	Gogerddan ...	22·83	106	Waterford ...	24·89	123
Alderbury	17·46	125	Llandudno ...	15·43	106	Broadford.. ...	22·51	130
Ashburton	33·90	137	Dumfries	23·44	105	Carlow	19·33	110
Polapit Tamar ...	27·92	155	Lilliesleaf	18·94	121	Dublin	13·92	97
Stroud	17·47	123	Colmonell.....	21·31	97	Mullingar.....	21·32	111
Woolstaston	16·92	114	Glasgow	20·80	113	Ballinasloe ...	22·39	118
Boston	12·01	113	Inveraray	37·96	104	Clifden	49·89	122
Hesley Hall	12·99	121	Islay	26·64	119	Crossmolina ...	35·58	135
Derby.....	12·38	101	Mull	33·27	118	Seaforde	19·86	104
Bolton	18·46	81	Loch Leven ...	19·03	103	Londonderry..	21·14	101
Wetherby	16·51	132	Dundee	13·70	97	Omagh	24·75	123

The aggregate rainfall of the seven months is below the average of the ten years 1890-99 in the east and north-west of England, in the north and south-west of Scotland, and in the neighbourhood of Dublin. It considerably exceeds the average only in the south-west of England; and, bearing in mind the fact that the ten years yielding this average were dry years, it cannot be wrong to say that so far the British Isles have not had more than the average amount of rainfall during the year 1904.

The fineness of the summer months has been a pleasant contrast to the state of matters last year, and complaints, where complaints are heard, deal with droughts rather than floods. Taken as a whole, the rainfall of the British Isles for the first seven months of 1903 showed an excess of 37 per cent., and in 1904 of 9 per cent. above the ten years' average; or an excess of over 25 per cent. of the true average in 1903, and nothing in 1904.

Still, while the greater part of the country has been very much drier this year than last, several stations in the south-west of England and in Ireland have had more rain. The relatively driest part of the country has been the north-east of Scotland; the relatively wettest the peninsula of Devon and Cornwall.

RAINFALL AND TEMPERATURE, JULY, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. Shade	Grass.
		inches	inches.	in.								
I.	London (Camden Square) ...	2·41	+ ·16	1·71	25	10	88·9	17	49·7	4	0	0
II.	Tenterden ...	2·16	— ·44	·69	30	8	86·0	17	50·0	2	0	0
,,	Hartley Wintney ...	2·06	— ·30	·47	2	9	86·0	17	48·0	1, 21	0	0
III.	Hitchin ...	3·78	+ 1·37	2·62	25	11	84·0	15	48·0	18	0	...
,,	Winslow (Addington) ...	2·74	+ ·27	1·47	25	12	84·0	10, 17	48·0	4, 8	0	0
IV.	Bury St. Edmunds (Westley)	2·51	— ·40	·59	27	10	86·0	17	47·0	19	0	...
,,	Brundall ...	1·85	— 1·02	·60	25	9	86·8	15	46·2	4	0	0
V.	Alderbury ...	2·27	— ·05	·60	25	11	82·0	10	46·0	1	0	...
,,	Winterborne Steepleton ...	3·87	...	1·12	29	13	80·8	17	45·8	9	0	0
,,	Torquay (Cary Green) ...	4·62	...	·85	26	16	77·9	17	50·1	4	0	0
,,	Polapit Tamar [Launceston]	5·73	+ 2·71	1·50	26	23	82·6	19	36·9	8	0	...
,,	Bath ...	2·45	...	·72	25	12	83·5	10	48·2	8	0	...
VI.	Stroud (Upfield) ...	3·46	+ ·85	·89	26	12	83·0	10	48·0	28	0	...
,,	Church Stretton (Woolstaston)	3·06	+ ·73	2·48	25	14	76·0	11, 19	61·0	2	0	...
,,	Bromsgrove (Stoke Reformatory)	2·49	+ ·70	1·65	25	10	81·0	9	41·0	1	0	...
VII.	Boston ...	3·05	+ ·93	1·00	24	10	87·0	9	45·0	2	0	...
,,	Bawtry (Hesley Hall) ...	3·60	+ 1·63	1·02	24	10	82·0	11	40·0	8, 19	0	...
,,	Derby (Midland Railway) ...	1·95	— ·36	·91	25	11	88·0	10	47·0	1, 7	0	...
VIII.	Bolton (The Park) ...	1·71	— 2·39	·40	4	16	78·4	11	44·4	8	0	0
IX.	Wetherby (Ribston Hall) ...	2·08	— ·21	·70	24	12	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	2·40	— 2·63	·93	23	15	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	3·35	+ 1·03	1·50	24	12	82·0	15	44·0	19	0	0
X.	Newcastle (Town Moor) ...	1·49	— 1·20	·32	25	14	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	8·51	— ·90	3·00	16	16	82·3	11	46·5	18	0	...
XI.	Cardiff (Ely) ...	5·12	+ 1·88	1·80	25	20	...	...	...	...	...	...
,,	Haverfordwest (High St.) ...	1·95	— 1·39	·32	30	19	83·6	10	40·2	8	0	0
,,	Aberystwith (Gogerddan) ...	2·61	— 1·01	·83	25	13	93·0	10, 11	35·0	29	0	...
,,	Llandudno ...	2·37	— ·21	·66	24	20	80·2	11	49·8	8	0	...
XII.	Cargen [Dumfries] ...	3·83	+ ·49	1·78	15	12	83·0	11	43·0	7	0	...
XIII.	Edinburgh (Royal Observy.)	1·19	...	·40	15	13	70·4	29	46·8	4	0	0
XIV.	Colmonell ...	3·20	·00	·70	14	13	82·0	11	41·0	17	0	...
XV.	Tighnabruaich ...	4·08	...	·79	14	18	70·0	11	40·0	16	0	0
,,	Mull (Quinish) ...	2·87	— 1·24	·83	14	19	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	2·02	— 1·05	·90	16	11	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	1·15	— 1·21	·30	3, 15	11	75·8	13	44·0	4	0	...
XVII.	Braemar ...	1·73	— 1·04	·37	22	12	74·8	10	38·2	18	0	2
,,	Aberdeen (Cranford) ...	1·32	— 1·31	·60	2	10	71·0	8, 30	43·0	2	0	...
,,	Cawdor (Budgate) ...	·63	— 2·79	·27	20	9	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	2·38	— 4·52	·61	6	19	78·9	12	34·0	31	0	...
,,	Bendamph ...	3·16	— 2·33	·63	6	17	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	1·14	— 1·56	·41	3	9	72·0	30	44·0	19	0	...
,,	Castletown ...	1·04	...	·26	2	14	76·0	31	40·0	19, 20	0	...
XX.	Killarney ...	5·10	+ ·68	·84	15	23	82·5	11	40·5	7	0	...
,,	Waterford (Brook Lodge) ...	3·83	+ ·45	·72	14	18	77·0	11	42·0	7	0	...
,,	Broadford (Hurdlestown) ...	4·11	+ 1·13	·56	19	23	77·0	11	42·0	6, 7	0	...
XXI.	Carlow (Browne's Hill) ...	3·34	+ ·39	·95	15	17	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·09	— 1·49	·32	15	15	74·7	30	48·0	7	0	0
XXII.	Ballinasloe ...	3·78	+ ·51	·70	26	20	80·0	11	44·0	7, 16	0	...
,,	Clifden (Kylemore House) ...	8·85	+ 2·26	1·70	25	19	...	...	...	...	...	...
XXIII.	Seaforde ...	2·31	— ·88	·34	4, 28	17	76·0	9, 10	47·0	15	0	0
,,	Londonderry (Creggan Res.)	4·05	+ ·35	·52	19	21	...	...	...	...	...	...
,,	*Omagh (Edenfel)* ...	4·41	+ ·86	·72	19	22	80·0	11	45·0	15	0	0

+ Shows that the fall was above the average; — that it was below it.

SUPPLEMENTARY RAINFALL, JULY, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·40	XI.	New Radnor, Ednol	2·75
,,	Sheppey, Leysdown	1·15	,,	Rhayader, Nantgwillt	...
,,	Hailsham	1·26	,,	Lake Vyrnwy	2·76
,,	Crowborough	1·09	,,	Ruthin, Plâs Dràw	1·65
,,	Ryde, Beldornie Tower	1·00	,,	Criccieth, Talarvor	2·30
,,	Emsworth, Redlands	2·12	,,	Anglesey, Lligwy	1·86
,,	Alton, Ashdell	1·26	,,	Douglas, Woodville	2·31
,,	Newbury, Welford Park	2·38	XII.	Stoneykirk, Ardwell House	4·08
III.	Harrow Weald	2·95	,,	Dalry, Old Garroch	3·35
,,	Oxford, Magdalen College	3·05	,,	Langholm, Drove Road	5·34
,,	Banbury, Bloxham	3·10	,,	Moniaive, Maxwelton House	3·77
,,	Pitsford, Sedgebrook	2·61	,,	Lilliesleaf, Riddell	2·65
,,	Huntingdon, Brampton	1·53	XIII.	N. Esk Reservoir [Penicuick]	2·80
,,	Wisbech, Bank House	1·84	XIV.	Maybole, Knockdon Farm	1·77
IV.	Southend	2·74	,,	Glasgow, Queen's Park	3·81
,,	Colchester, Lexden	3·07	XV.	Inveraray, Newtown	4·11
,,	Saffron Waldon, Newport	2·21	,,	Ballachulish, Ardsheal	5·31
,,	Rendlesham Hall	1·83	,,	Campbeltown, Redknowe	3·09
,,	Swaffham	2·91	,,	Islay, Eallabus	3·77
,,	Blakeney	3·37	XVI.	Dollar	2·36
V.	Bishop's Cannings	3·18	,,	Balquhidder, Stronvar	4·71
,,	Ashburton, Druid House	5·04	,,	Coupar Angus Station	2·28
,,	Okehampton, Oaklands	3·88	,,	Blair Atholl	1·77
,,	Hartland Abbey	4·10	,,	Montrose, Sunnyside	1·09
,,	Lynmouth, Rock House	3·27	XVII.	Alford, Lynturk Manse	1·61
,,	Probus, Lamellyn	5·25	,,	Keith, H.R.S.	·86
,,	Wellington, The Avenue	3·14	XVIII.	Fearn, Lower Pitkerrie	3·03
,,	North Cadbury Rectory	3·80	,,	S. Uist, Askernish	2·29
VI.	Clifton, Pembroke Road	4·40	,,	Invergarry	2·18
,,	Moreton-in-Marsh, Longboro'	3·09	,,	Aviemore, Alvie Manse	1·04
,,	Ross, The Graig	1·90	,,	Loch Ness, Drumnadrochit.	·87
,,	Shifnal, Hatton Grange	1·72	XIX.	Invershin	·75
,,	Wem Rectory	2·48	,,	Altnaharra	1·47
,,	Cheadle, The Heath House.	2·31	,,	Bettyhill	1·28
,,	Coventry, Kingswood	2·32	,,	Watten, H.R.S.	1·53
VII.	Market Overton	3·57	XX.	Cork, Wellesley Terrace	3·56
,,	Market Rasen	3·37	,,	Darrynane Abbey	5·27
,,	Worksop, Hodsock Priory	2·23	,,	Glenam [Clonmel]	4·37
VIII.	Neston, Hinderton	1·74	,,	Ballingarry, Hazelfort	3·37
,,	Southport, Hesketh Park	1·02	,,	Miltown Malbay	6·68
,,	Chatburn, Middlewood	1·81	XXI.	Gorey, Courtown House	2·56
,,	Duddon Valley, Seathwaite Vic.	5·74	,,	Moynalty, Westland	3·54
IX.	Langsett Moor, Up. Midhope	1·81	,,	Athlone, Twyford	3·88
,,	Baldersby	1·67	,,	Mullingar, Belvedere	3·21
,,	Scalby, Silverdale	1·66	XXII.	Woodlawn	3·47
,,	Ingleby Greenhow	2·61	,,	Westport, Murrisk Abbey	6·07
,,	Middleton, Mickleton	2·29	,,	Crossmolina, Enniscoe	5·60
X.	Beltingham	1·54	,,	Collooney, Markree Obsy	4·53
,,	Bamburgh	1·15	XXIII.	Enniskillen, Portora	4·27
,,	Keswick, The Bank	3·28	,,	Warrenpoint	3·43
,,	Melmerby Rectory	2·32	,,	Banbridge, Milltown	2·96
XI.	Llanfrechfa Grange	4·85	,,	Belfast, Springfield	3·75
,,	Treherbert, Tyn-y-waun	5·67	,,	Bushmills, Dundarave	2·61
,,	Llandovery, Tonn	3·27	,,	Stewartstown	4·35
,,	Castle Malgwyn	1·95	,,	Killybegs	3·99
,,	Llandefaelog-fach	...	,,	Horn Head	3·19

METEOROLOGICAL NOTES ON JULY, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A fine, warm and sunny month, which would have been very deficient in R but for a fall of 1·71 in. on the evening of 25th, in the course of which during a severe TS ·61 in. of R fell in 20 minutes. The duration of sunshine 234·8 hours* and of R 20·8 hours. Mean temp. 66°·5 or 3°·2 above the average. Max. above 80° on 11 days.

TENTERDEN.—A glorious summer month. Duration of sunshine 293 hours 25 mins.† Temp. 75° or more on 17 days and on four over 80°. Several TS8, especially in the last week.

CROWBOROUGH.—Fine, dry and warm, with deficient R. TS8 on 3rd, 12th and 30th. Mean temp. 62°·9.

HARTLEY WINTNEY.—A "mensis mirabilis." The first three days were stormy, with R, followed by a spell of glorious summer weather till 25th; hot, dry and dusty. The closing days were showery, with absence of T, and beautiful nights. Ozone on 14 days with a mean of 2·1.

HITCHIN.—Since 1849 there had been only three hotter Julys. The fall of 2·62 in. on 25th was the heaviest in 24 hours since October, 1857.

ADDINGTON MANOR.—Little R until the end, but a heavy TS on 25th, when a large oak tree was struck by L.

PITSFORD.—A month of warmth and sunshine. R 1·00 in. below the average. Mean temp. 63°·8. T, L and heavy R on 25th.

COLCHESTER.—Very dry till 25th, accentuated by E. wind and great heat. Crops and all vegetation except large trees suffered much. On 25th there was a violent TS passing directly over this garden. From 5.55 to 6.6¾ p.m. ·37 in. of R fell; from 6.6¾ to 6.13, ·57 in., and from 6.13 to 6.20, ·38 in., making 1·32 in. in 25 minutes.

BURY ST. EDMUNDS.—Very hot and dry till 25th, after which 2·10 in. of R fell.

BRUNDALL.—Very hot, with mean temp. 3°·0 above the average. Severe storms of T and R during the last few days.

WINTERBOURNE STEEPLETON.—Temp. above the average, especially during the second fortnight. The R nearly all fell in the last week. T and L on 12th and 19th.

TORQUAY.—R 2·22 in. above the average, 4·18 in. falling from 22nd to 29th. Duration of sunshine 240·8 hours* or 5·2 hours above the average. Mean temp. 62°·8 or 1°·1 above the average. Mean amount of ozone 3·8.

NORTH CADBURY.—The first five days were cloudy, showery and cool, after which it was hot, dry and bright till 24th, then tremendous rains, excessive humidity and gloom turned a hitherto dry month into the wettest July in 8 years, and wetter than any month in 1903, except October.

CLIFTON.—Fine and hot with little exception till 22nd, when the weather broke up. TS8 on 19th and 25th and torrential rains on 25th (1·22 in.) and 26th (1·18 in.), followed by daily R till the end, 3·32 in. falling in the last week.

ROSS.—The dry weather which had persisted from June 1st continued till July 21st, with the exception of a slight T shower on 19th. The Wye was unusually low and within an inch of record minimum height. From 22nd to 29th frequent refreshing showers occurred. The great heat from 6th to 25th enabled the later grass crops to be well secured and rapidly ripened grain crops.

WOOLSTASTON.—There was a very heavy TS on 25th lasting from 2.45 to 3.45 p.m., the R in the hour being 1·26 in. A tall Wellingtonia only 15 yards from the rectory was struck by L.

BOLTON.—The weather was highly favourable to agriculture. The duration

of sunshine was 151 hours 55 minutes,* or 1 hour above the average. The mean temp., 60°·9, was 0°·6 above the average, and the R was sufficient for steady growth owing to moisture in the soil. The hay crop was secured in excellent condition. T and L on 2nd and 12th; T on 23rd and 31st, and L on 24th.

SOUTHPORT.—Warm and very dry with large mean daily range of temp. and low humidity. Mean temp. 2°·1 above the average. R 2·13 in. below the average of 32 years. Underground water low.

HULL.—Exceptionally warm throughout, with hot, dry periods, succeeded by copious rain, followed again by fine weather. T on 2nd and 23rd, and T and L on 25th and 30th.

LLANDOVERY.—Changeable, but fine on the whole. Several TSS occurred, and there was a very brilliant display of L on the night of 19th. Range of temp. on 7th 40° and on 8th 41°.

HAVERFORDWEST.—The finest and warmest July since 1900. Temp. reached 70° or more on 11 days. Distant TS on 12th. Duration of sunshine 226·7 hours.*

DOUGLAS.—On the whole a pleasant month. The first days were cold and unsummerlike, but the weather improved thereafter, although only 25 hours sunshine were recorded in the last week. A remarkably severe gale lasted some 50 hours, including 14th and 15th. TSS on 12th and 25th.

SCOTLAND.

CARGEN [DUMFRIES].—Grand hay weather, and corn and green crop prospects exceptionally good. More than half the R fell between midnight and 10 p.m. on 15th.

LILLIESLEAF.—R ·35 in. below the average. Heavy R on four days, but no T. Remarkably heavy growth of vegetation. Little sunshine.

MULL, QUINISH. Fine and warm. R always sufficient and never excessive.

COUPAR ANGUS.—Bright sunshine and blue sky were deficient, and a struggling sun through a hazy atmosphere predominated, with a small daily range of temp.

DRUMNADROCHIT.—The R was less than half the previous lowest in 18 years, and 2·12 in. below the average of that period. Vegetation suffered much from drought, and in some cases cattle had to be turned into cornfields for want of grass.

BETTYHILL.—With the exception of a little in the early part, there was scarcely any R, and crops and pasture were failing.

WATTEN.—Cloudy, fine and very dry, though with few sunny days.

CASTLETOWN.—The first part was warm and showery with westerly winds, and the latter warm and very dry, with light variable winds and cloudy and overcast skies.

IRELAND.

DARRYNANE ABBEY.—Wet, with some fine and hot intervals. R 34 per cent. above the average.

MILTOWN MALBAY.—Sultry and wet, with much T during the last fortnight. The heaviest R but one for 32 years. On the night of 25th 2·85 in. fell in 8 hours. Potato blight everywhere.

DUBLIN.—Warm and generally fine. The R was small but fell on 15 days, although more than half fell on 15th and 25th. TS on 19th.

MARKREE OBSERVATORY.—The first part was fine and dry, but from 19th heavy showers fell, and there were frequent TSS.

OMAGH.—Although the R was above the average, it fell so largely at night that, accompanied as it was by higher temp., it seemed much drier than July, 1903, which had smaller R. Fruit, both large and small, was quite phenomenal, and ordinary crops promised equal abundance. Little T or L.

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* Campbell-Stokes. † Jordan

Climatological Table for the British Empire, February, 1904

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	54·3	20	27·9	29	44·6	34·8	35·2	86	85·6	41·4	2·58	19	7·1
Malta	68·7	3	44·3	26	62·5	51·6	47·2	77	111·9	39·8	·89	6	3·7
Lagos, W. Africa	91·0	7,16	68·0	25	87·6	74·0	73·2	71	139·5	63·0	1·17	2	2·7
Cape Town	96·8	3	54·4	7,8	79·8	62·0	57·7	64	...	...	·09	2	3·2
Durban, Natal	95·4	7	61·4	1	84·4	67·7	...	...	151·5	...	8·77	18	4·7
Mauritius	89·9	22	70·4	3	85·7	73·2	71·3	78	152·8	66·0	4·92	22	7·5
Calcutta	90·4	28	47·0	2	82·9	59·1	56·8	62	145·8	40·4	2·58	2	0·9
Bombay	91·2	13	66·8	6	85·3	70·5	66·2	69	139·2	58·4	·00	0	1·7
Madras	87·0	29	61·2	1	84·4	66·7	66·6	76	138·7	56·4	·00	0	2·1
Kodaikanal	71·1	15	42·6	27	64·7	46·6	37·8	53	135·1	23·4	·15	3	3·0
Colombo, Ceylon	92·7	25	65·0	3,4	87·9	70·9	69·3	76	152·7	59·2	2·05	4	3·2
Hongkong	73·5	21	52·5	9	68·1	58·5	52·7	69	127·6	...	·20	3	3·7
Melbourne	96·7	18	49·0	29	73·7	56·8	54·4	73	153·2	41·8	6·24	10	6·3
Adelaide	104·0	17	52·0	28	81·4	61·5	51·3	51	153·6	47·2	·27	6	4·9
Coolgardie	107·5	3	48·2	25	88·6	60·1	48·5	40	180·5	44·0	·00	0	1·4
Sydney	84·2	...	52·5	...	76·1	63·3	59·2	69	126·9	48·1	3·95	15	5·6
Wellington	80·4	10	47·3	20	70·9	55·6	51·9	67	132·0	42·0	2·26	7	5·9
Auckland	79·5	18	53·0	20	72·6	59·7	57·2	74	147·0	48·0	3·71	9	4·5
Jamaica, Negril Point	88·5	19	64·3	28	84·3	68·1	68·6	79	...	...	4·50	9	...
Trinidad	87·0	sevl	61·0	24*a*	84·6	65·7	69·3	83	167·0	58·0	2·56	16	...
Grenada	84·8	26	68·4	22	80·9	71·1	68·6	75	150·4	...	3·33	19	2·9
Toronto	42·0	28	−10·5	16	22·3	4·3	13·5	85	88·0	−18·0	3·00	12	5·5
Fredericton	49·8	22	35·0	6	22·9	−0·2	4·7	61	...	...	2·79	13	5·1
Winnipeg	36·0	27	−35·8	9	3·2	−18·9	...	...	...	...	·71	6	4·0
Victoria, B.C.	49·3	21	24·5	8	43·3	35·5	...	...	...	...	3·93	22	8·2
Dawson	−3·0	1	−48·0	4	−17·8	−31·7	...	...	...	...	·36	5	3·8

a and 25, 26.

MALTA.—Mean temp. of air 56°·6 or 2°·5 above, mean hourly velocity of wind 13·8 or 2·1 above, averages. Mean temp. of sea 59°·9.

Mauritius.—Mean temp. of air 0°·2, dew point 0°·4 above, and R 2·03 in. below, averages. Mean hourly velocity of wind 9·5 miles, or 1·5 mile below average.

KODAIKANAL.—Mean temp. of air 53°·9. Mean velocity of wind 329 miles per day. Bright sunshine 239·3 hours.

CEYLON, COLOMBO.—Mean temp. of air 79°·0 or 1°·3 below, dew point 1°·2 below, and R ·02 in. below, averages. Mean hourly velocity of wind 9 miles; prevailing direction N.

HONGKONG.—Mean temp. of air 62°·6. Bright sunshine 207·5 hours. Mean hourly velocity of wind 13·9 miles; mean direction E.

Adelaide.—Mean temp. of air 2°·6 below, and R ·35 in. below, normal.

Sydney.—Mean temp. of air 1°·3, humidity 3·5, and R ·93 in. below, averages.

Wellington.—Mean temp. 1°·9 above, and R ·38 in. above, averages; prevailing winds, N. and N.W.

TRINIDAD.—R ·91 in. above the 40 years' average.

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METEOROLOGY AT THE BRITISH ASSOCIATION.

The meeting of the British Association for the Advancement of Science, at Cambridge, in 1904, will rank amongst the very best of the long series since these gatherings began. The place lends itself remarkably to the occasion. The meeting-rooms were adequate, and in almost every case pleasantly as well as conveniently situated. The Colleges were thrown open with a dignified hospitality worthy of their splendid halls and gardens, while private hosts vied with them in the generous reception and entertainment of visitors. The weather was neither bad nor good, but of a fair average, permitting outdoor functions, but rarely permitting them to be altogether perfect.

The President of the Association is this year the most popular statesman in the country, and since the Association permits itself to stray beyond the votaries of science in its choice, it could not secure a better head than the present Prime Minister, for Mr. Arthur Balfour alone amongst parliamentary leaders is admired and esteemed for his great learning and attractive personal qualities no less warmly by his political opponents than by his supporters. He delivered an address on the philosophic aspects of some fundamental scientific facts, in a manner altogether agreeable.

A special International Committee on the relation between meteorological and cosmical phenomena, brought together several meteorologists from other countries. The sub-section of Section A devoted to Cosmical Physics, including astronomy and meteorology, was presided over by Sir John Eliot, F.R.S., part of whose address, admirably summarising his work of a lifetime as the head of the Indian Meteorological Service, we reprint in the present number. Numerous papers on meteorological subjects were read, and the more important of these will be reprinted in abstract in our pages, so that it is unnecessary to give a list of titles here.

The annual Meteorological Breakfast was held on Tuesday, 23rd August, at 9 a.m., when forty-three meteorologists and observers sat down. The names of those who took part are :—

Ackroyd, W.
Aitken, J., F.R.S.
Amery, Fabyan S.
Angot, A., Central Meteorological Institute, Paris.
Ashworth, Dr. J. R.
Backlund, Dr. O., Pulkovo, Russia.
Biggs, J. H. W.
Bolton, John
Boys, C. V., F.R.S.
Chree, Dr. C., F.R.S.
Cohen, R. Waley.
Cotton, G., Lagos, West Africa.
Creak, Capt. E. W., C.B., F.R.S.
Crowley, F.
Eliot, Sir John, K.C.I.E., F.R.S.
Guillemard, Dr. F. H. H.
Harmer, F. W.
Hepworth, Capt. Campbell, C.B.
Hettner, Prof. Dr. A., Heidelberg.
Hopkinson, J.
Knott, Dr. C. G.
Lempfert, R. G. K.
Lockyer, Sir Norman, K.C.B., F.R.S.
Lockyer, Dr. W. J. S.
Matthews, D. J.
Mill, Dr. H. R.
Milne, Prof. J., F.R.S.
Moncrieff, Col. Sir C. Scott, K.C.M.G.
Parker, Rev. Dr. J. D.
Plummer, W. E.
Ricco, Prof. A., Cantania, Sicily.
Rotch, A. Lawrence, Blue Hill Observatory, Massachusetts.
Shaw, Dr. W. N., F.R.S.
Smyth, J.
Southall, H.
Steen, Aksel S., Meteorological Institute, Christiania
Symons, Dr. W. H.
Tabor, H. S.
Varley, W. M.
Warner, A.
Wilson, C. T. R., F.R.S.
Wilson, W.
Wind, Dr. C. H., Meteorological Institute, de Bilt, Holland.

The key-note of this breakfast is its absolute informality. Sir John Eliot, as President of the Section dealing with Meteorology, expressed in a few words the welcome of the English-speaking meteorologists to their brethren from the continent. Dr. H. R. Mill made a few remarks on the origin and motive of the breakfast, pointing out that it was a spontaneous meeting of those interested in the same things and desirous of becoming acquainted with each other. No invitations were issued, but foreign guests were entertained by such of the British meteorologists as cared to share the trifling expense. An intimation was sent to all those likely to be interested whose names appeared in the first list of members, but as the identification marks in that list are often not very clear, omissions might occur inadvertently, but all who understood the tradition of the breakfast and heard it was to take place came of their own initiative.

Address to the Sub-Section Cosmical Physics,

By Sir John Eliot, K.C.I.E., M.A., F.R.S.

India is the most typical example of monsoon conditions, that is, of opposite air movements of six-monthly period which, in its case, depend on the annual temperature changes in the sea and land areas of the Indian Ocean and continent of Asia. The monsoon conditions in India are intensified by its unique position and topography. It projects southwards into the Indian seas over 15° of latitude, and is protected northwards by the vast barrier of the Himalaya Mountain range and Tibetan plateau. The axis of the Himalayan range is at least 2000 miles in length and has an average elevation of over 20,000 feet. The extent of country over 10,000 feet in elevation to the north of India is from 300 to 500 miles in width.

These figures will give some idea of the magnitude of India's northern barrier.

During one period of the year there is an outflow in the lower atmosphere from land to sea. The direction of the lower air drift in India is determined in part by the lie of the mountains and river valleys, and is from north-east over the greater part of the Indian seas. January is the month most typical of this air movement and of the accompanying weather conditions.

During another portion of the year the lower horizontal air movement is from sea to land. This movement is much steadier and more powerful and influential in every respect than the former. July and August are the months most representative of the totality of the weather conditions of this period.

* * * * * * *

The regions of rainfall indicate the areas of upward movement terminating the lower advance of the current. The circulation is undoubtedly maintained in large part by the release or addition of energy due to the condensation of its enormous stores of aqueous vapour. The lower air movement is of very considerable elevation, estimated at 15,000 to 20,000 feet in India. Above it is the outward upper return movement, in part only compensatory, and in part probably slowly filling up the Central and Southern Asian low-pressure region. The movement exhibits some interesting features in India, due to the fact that of the three areas to which it is mainly determined India alone is subject to a double influx from two sea areas in opposite directions. The current from the Arabian Sea passes eastwards across the Malabar, Konkan, and North Bombay coasts, the peninsula and Central India. The Bengal current is deflected in the north of the Bay and Bengal, and advances in a westerly direction up the Gangetic plain. Between the areas or two fields of the two currents (roughly proportional to their relative strength and importance—viz., about 2 to 1) is a debatable area of variable winds and low pressure. This trough of low pressure varies in position with the relative strengths of the two currents. The cyclonic storms of the period, which are of comparatively frequent occurrence, advance along the trough. It is hence a factor of considerable importance in determining the distribution of the rainfall of the period. The trough is purely a resultant of the peculiar conditions of the air movement, and is not the cause of that movement; in other words, it is determined by it, and does not determine it.

* * * * * * *

The year in India may hence be divided into two monsoons of nearly equal length,—(*a*) The north-east or dry monsoon; (*b*) The south-west or wet monsoon.

The first terms are based on the general direction of the air movement in the Indian seas during the periods, and the second on the most prominent feature of the weather in India itself. Of an average annual total rainfall of 41 inches (according to the most trustworthy calculation), at least 85 per cent. falls during the wet season, and only 15 per cent. during the dry season.

The dry monsoon in India is subdivided into—(1.) The cold-weather period; (2.) The hot-weather period or transitional period of preparation for the south-west monsoon.

The wet monsoon is subdivided into—(1.) The south-west monsoon proper, or period of general rains. (2.) The period of the retreating south-west monsoon and gradual slow establishment of the dry monsoon.

One of the most noteworthy features of the meteorology of India is that the storms of each period—viz., the cold-weather period, the hot-weather period, and the wet monsoon—are characteristic and special to the period. They are all in the broadest sense of the word cyclonic in character; but they originate under different conditions and exhibit very different features in each of those periods.

The disturbances of the cold weather are large shallow depressions which originate in the upper humid return current of the north-east monsoon circulation, chiefly in the Persian plateau region, and which drift eastward with a slight southing across extra-tropical India. Storms do not occur south of the Deccan or peninsula-dividing ranges during this period. These storms are chiefly remarkable for the frequent development of stationary secondary depressions in the Punjab, usually of much greater intensity than the primaries; a feature of which, I believe, there is no parallel elsewhere. They are of great importance, as they give the main snow supply to the Western Himalayas and the light but general occasional rain required for the wheat and other cold-weather crops of Northern India.

The storms of the hot weather are local disturbances of very limited extent, usually in large areas of slight depression, and are occasionally of remarkable intensity and great violence. In the areas to which the local sea winds of the period extend (more especially Bengal and Assam) they occur chiefly as local thunderstorms with violent winds and brief heavy downpours of rain, but sometimes as tornadoes rivalling those of certain districts of the United States in intensity and destructiveness. In the dry interior they occur as dust-storms, usually without rain, and are most violent in the driest districts, including Sind, the Punjab, and Rajputana. Occasionally, when the convective movement is especially vigorous, they develop into hailstorms of great intensity. The rainfall accompanying these hot-weather storms is of little general agricultural value except in the tea districts of Assam and Bengal.

Finally, the wet monsoon is characterised by the frequent occurrence of cyclonic storms of every degree of intensity and of very varying extent. The great majority of them originate in sea areas of nearly uniform temperature as disturbances in a massive current highly charged with aqueous vapour and subject to large variations of intensity and extension. The more prominent features of these storms, more especially of the most violent, including the hurricane winds, excessive rainfall, and the phenomena of the central calm and the accompanying storm wave, are too well known to require description. The chief importance of these storms, of which an average of about ten (of different degrees of intensity) occurs every year during this period, arises from the manner in which they modify the distribution of the rainfall, discharging it abundantly over the districts traversed by the storms at the expense of the districts outside of their field.

The most important and variable feature of the weather in India from the practical standpoint is rainfall. Its value depends upon its amount and occurrence in relation to the needs of the staple crops. The measurement of rainfall is carried out, on a uniform system, at upwards of 2500 rain

gauge stations. The average distribution of rainfall, month by month and for each season, has been determined from the data of about 2000 stations. It should, however, be recognised that the probability that the rainfall will conform exactly to this distribution in any year is *nil*. Average rainfall charts represent a distribution about which the actual varies from district to district more or less considerably, the local variation for prolonged periods being practically compensatory. Such mean or normal data and charts are undoubtedly of value, more especially for the determination of rainfall anomalies and their relations to pressure, temperature, and other anomalies. There is apparently a tendency to assign a greater value to these charts of mean rainfall distribution than they deserve. Charts showing the amount and time distribution of the rainfall best suited for the requirements of the staple crops would—for India at least—be more interesting and valuable. This is a work that I regret has, for various reasons, not yet been carried out by the Indian Meteorological Department.

In most regions in India a moderate variation (positive or negative) in the amount of the rainfall is of comparatively small importance, more especially if the precipitation occurs in amount and at intervals suited to the requirements of the crops. During the thirty-year period 1874–1903 there were six years in which the distribution of rainfall affected to a serious extent the crop returns over large areas, and the rainfall was not compensatory. In four of these years the drought was so severe and widely spread as to occasion famine, with its attendant calamities, over large areas. Severe droughts and famines occur at very irregular intervals. A noteworthy feature is that they frequently follow in pairs separated by intervals of two to four years.

The following important inferences are based upon the preceding presentation of facts and the experience of the past thirty years :—

(1.) The lower air movement of the south-west monsoon is the northward extension of the lower movement of the south-east trades. The latter is a permanent feature of the Indo-oceanic region, and the former a periodic invasion of the Southern Asian seas and peninsulas initiated over equatorial regions and propagated northwards to the southern mountain barrier of the Central Asian plateau.

(2.) The primary factors determining this impulse across the equator (the first stage of the establishment of the south-west monsoon) are to be sought in the permanent field of the south-east trades, and are not due to actions in the heated areas of Southern or Central Asia.

(3.) The pressure conditions in the heated areas of Southern Asia and North-East Africa determine the direction, volume, and intensity of the advance over the Indian seas to what may be termed three competing areas for rainfall (viz., Abyssinia, India, and Burma). These conditions are hence important factors in the third stage of the advance of the south-west monsoon current.

(4.) The movement when fully established by these actions over the Southern Asian seas and peninsulas is continued—1st, by the momentum of the lower circulation ; 2nd, by the release of energy accompanying aqueous vapour condensation ; and 3rd, by thermal actions in Southern Asia, due to direct solar activity. The termination of the lower horizontal current by vertical movement occurs irregularly over the areas of frequent heavy

rain in Southern Asia and Abyssinia, and not over a heated area in Central Asia.

(5.) The total volume of aqueous vapour brought up by this circulation not only varies in amount from month to month during the season, but also from year to year. The largest variations (seasonal and annual) depend chiefly, if not entirely, upon actions in the source of supply—viz., the Indian Ocean. If those actions determine an increased or diminished supply across the equator into the Indian seas, there is a corresponding variation in the total precipitation of the three competing areas. Amongst such causes and actions may be prolonged and untimely diversion of the south-east trades into East Africa, as in 1896, or general weakness of the air movement over the Indian Ocean, probably accompanying a displacement and decreased intensity of the southern anticyclone, as in 1899.

(6.) The relative distribution of the total rainfall in the three areas of discharge of the aqueous vapour of the monsoon currents probably depends upon the relative intensities of the pressure conditions established during the hot weather, which are continued for a part or the whole of the monsoon by actions depending on the rainfall resulting from the initial pressure conditions—an example of the persistence of meteorological conditions and actions which is a prominent feature of Indian meteorology. The total rainfall of each of the three areas may differ considerably from the normal, but there may be partial or complete compensation on the whole. Thus it is the general (but not the invariable) rule that the rainfall variations in Burma and Assam are usually inverse to those of North-Western India and also of India as a whole.

(7.) The distribution of the rainfall in any one of the three competing areas (but more especially in India as the largest) may vary widely from the normal—considerable deficiency in some areas accompanying considerable excess in others. This in India is undoubtedly due to local conditions —*e.g.*, local excess or deficiency of pressure at the commencement of the period and established during the previous hot weather. These pressure variations usually accompany abnormally prolonged and heavy snowfall, or very scanty snowfall, in the Western Himalayas.

(8.) Local or general drought in India during the south-west monsoon may hence be due to—(*a*) General weakness of the south-east trades circulation. (*b*) Diversion of an unusually large proportion of the south-east trades to South-east or East Africa during the monsoon period. (*c*) Larger diversion than usual of the monsoon currents to Burma or Abyssinia. (*d*) Very unequal distribution in India itself, due to local conditions established during the antecedent hot weather.

(9.) Scanty rainfall or drought during the dry season or north-east monsoon in Northern India results from absence or unusual feebleness of the cold weather storms which are the sources of rainfall at that time.

(10.) The most prolonged and severe droughts in North-western and Central India are due to the partial or complete failure of the rainfall of at least two seasons in succession.

(11.) As the two circulations in the Indian oceanic region have a common goal in the dry season (more especially from December to March), it is probable that variations in the strength of one circulation (more especially the larger) will modify the field and strength of the other circulation. It

appears that this relation would be shown most strongly between the southern circulation and the upper movement of the northern circulation. And, as cold weather storms are disturbances in that upper movement, it is possible—if not probable—that the larger variations in the number and intensity of the cold-weather storms and the amount of the cold weather precipitation may be related to conditions in the south-east trades regions.

(12.) There appears to be little or no relation between the position and intensity of the Central Asian anticyclone and the number of the cold-weather storms and rainfall of Northern India in any season.

The meteorology of the period 1892—1902 is of especial interest for its confirmation of the above inferences, more especially the phenomena of the variations of rainfall in India and the causes to which they are due.

The period 1895—1902 was characterised by more or less persistent deficiency of rainfall over practically the whole Indo-oceanic area (including Abyssinia). The economic results in the dry interior districts of India, South Africa, and Australia, were the same—large loss of cattle and money. The drought in Southern Asia was as marked in the north-east as in the south-west monsoon, and hence the variation was not seasonal but general.

The variations of temperature, humidity, and cloud in India during the whole period were large and in direct accordance with the rainfall. In other words, during the period 1892–94 the air was damper with lower temperature than usual, and cloud above the normal. On the other hand, from 1895 to 1902 temperature was steadily in excess, and cloud and humidity less than usual.

The most interesting feature of the meteorology of the period 1892—1902 is that the variations of the solar insolation are the inverse of those which might have been expected from the cloud and humidity data. In other words, solar radiation was in excess in the period of increased humidity and cloud, and in defect during the greater part of the period of drought, decreased humidity, and cloud.

(To be continued).

Report of Kite Committee.

Investigation of the Upper Atmosphere by Means of Kites in co-operation with a Committee of the Royal Meteorological Society.—Third Report of the Committee, consisting of DR. W. N. SHAW *(Chairman)*, MR. W. H. DINES *(Secretary)*, MR. D. ARCHIBALD, MR. C. VERNON BOYS, DR. A. BUCHAN, DR. R. T. GLAZEBROOK, DR. H. R. MILL, *and* Professor A. SCHUSTER. *(Drawn up by the Chairman and Secretary.)*

THE Committee have acted throughout in conjunction with the Committee of the Royal Meteorological Society.

Since the date of the last report an account of the observations made in the summer of 1903 has been communicated to the Royal Meteorological Society and published in their *Quarterly Journal*.

In the interval between the meeting of the Association at Southport and the beginning of June experimental observations have been made at Oxshott; kites, of which various details have been altered, have been sent up almost every day on which the wind-force equalled or exceeded six on the Beaufort

scale. The object of these experiments was to ascertain if the behaviour of the kites could be improved by alteration of shape, size, &c., more particularly with regard to uniformity of pull and stability in winds of varying force.

As regards the first of these qualities considerable improvement has been effected by arrangements which will be described subsequently.

A new form of meteorograph has been designed for kite experiments by which the records of pressure, temperature, and humidity are traced upon a revolving disc of paper instead of a drum. (See this Magazine for July, p. 109.) It is made by Mr. Hicks, of Hatton Garden, under the supervision of Mr. Dines.

From the beginning of February till June ascents were made at Oxshott on every day specified by the President of the International Aëronautical Committee unless the wind was too light for work with kites.

As reported last year, an application made by the Royal Society to the Admiralty for the loan of a vessel for experiments with kites became inoperative in consequence of the accident to the ship which their lordships intended to place at the disposal of the Committee for the purpose. At the desire of the Royal Meteorological Society the Royal Society renewed the application for the loan of a vessel with a view to experiments in the summer, and their lordships assigned H.M.S. "Seahorse," a special service vessel of 600 tons and 1,000 horse-power, for the service, under the command of Staff-Captain F. W. A. Crooke, R.N., for six weeks from the middle of June. Mr. Dines visited Portsmouth to make preliminary arrangements, and the "Seahorse" arrived at Crinan on June 16th. The fitting of the winding engine was completed on June 18th, and the operations commenced on Monday, June 20th, and were continued daily until July 29th, with the exception of Sundays and the two days, July 9th and 11th, when the vessel was at Oban for the purpose of coaling. The approximate heights of the several ascents were as follows :—

Date.	Height reached. feet.	Date.	Height reached. feet.
June 20	3,250	July 8	5,000
,, 21	4,000	,, 13	8,500
,, 22	5,340	,, 14	1,750
,, 23	3,320	,, 15	8,060
,, 24	4,100	,, 16	6,050
,, 25	3,750		6,760*
,, 27	2,300	,, 18	1,200
,, 28	7,300	,, 19	4,200
,, 29	4,900	,, 20	2,680
,, 30	5,600	,, 21	5,500
July 1	5,500	,, 22	5,900
,, 2	4,400	,, 23†	—
,, 4	6,300	,, 25	5,310
,, 5	7,200	,, 26	5,280
,, 6	5,300	,, 27†	—
,, 7	7,350	,, 28	8,000

* Afternoon.

† No ascent owing to want of wind. Persistently calm weather prevailed on and after July 18.

The Committee take this opportunity of recording their thanks to the Royal Society for their action in the matter, to the Lords of the Admiralty or the loan of the "Seahorse," and to Staff-Captain Crooke and the officers

and men of his vessel for the manner in which they contributed to the carrying out of the observations. An account of the results of the experiments will be published later.

In the course of correspondence with Mr. E. W. L. Holt, of the Fishery Branch of the Irish Board of Agriculture Technical Instruction, Dr. Shaw learned that there was a prospect of occasional kite observations on board the s.s. "Helga," belonging to the Board, provided that the Department was not called upon to defray the expenses of the necessary apparatus and materials. Dr. Shaw reported the matter to the Committee, and reported, further, that if the Committee were willing to supply apparatus and gear for the experiments on the "Helga" the Meteorological Council were prepared to make arrangements with Mr. Dines to initiate the experiments and explain the method of working the apparatus.

The meeting of the Committee of Section A of the British Association formed a resolution desiring the Council to take steps to urge upon the Government the provision of means for co-operating in an organised union with the Continental nations and with India and America in the investigation of the upper air by means of balloons and kites. The decision of the Government with regard to the matter is nevertheless intimately connected with the action intended with regard to the Report of the Meteorological Grant Committee of the Treasury. The Committee's report was published in June, and refers in favourable terms to the proposed investigation, but suggests no specific grant for the purpose. The action of the Government with regard to the finding of the report has not yet been made known.

Nothing is therefore ascertained as to the prospects of an investigation of the upper air of this country upon an official basis. In the meantime Mr. Dines is likely to be able with the apparatus in hand to obtain kite observations on the fixed days of the Meteorological Committee, and to make further investigations with regard to improvements of the kites and apparatus. With regard to the latter an easy means of calibrating the meteorograph is required, and this involves the use of a suitable air-tight inclosure which might be used for similar operations in future. The Committee therefore ask for re-appointment, with a grant.

On Upper Currents and their Relation to the Hearing of Far Sound. *By* JOHN M. BACON.

INVESTIGATIONS carried out during a long series of balloon ascents have revealed a very remarkable complexity in the upper air-currents which, from their nature, would escape the notice of the observer on earth. A number of light bodies, of varying sizes and differently constituted, have been prepared and allowed to float away into space at different heights and under different circumstances; and these, carefully watched, have shown the existence of minor but headlong currents, holding determined courses frequently at variance with that of the balloon. It has been proved that dominant but diverse air-streams will glide one above another in juxtaposition without commingling, and that upper currents maintaining the same level will occasionally alter their course, presumably in obedience to some configuration of the earth below; while, at all heights, ascending or

descending air-streams, greater or lesser, will obtrude themselves in a way which is often wholly unaccountable.

In a manner equally capricious, and apparently dependent on the above, sounds conveyed through the upper air will be carried sometimes to abnormal distances in directions at variance with the ground current, being borne to earth over far but favoured plots of ground, while they may pass unheard over districts which might be considered well within sound range. These results, which have been obtained largely by organised observation of the hearing of aerial bombs, will presumably account for the occasional surprisingly far travel of sound signals; or, again, their failure at short ranges.

THE DINES RECORDING BAROMETER.

THE accompanying illustration shows so clearly the mechanism of the new recording barometer devised by Mr. W. H. Dines and made by Mr. J. J. Hicks, that it is unnecessary to describe the parts in detail. It will be observed that the lower and upper cisterns are of very wide bore compared with the connecting part of the tube. The motion of the float in the lower, or open, cistern is magnified and transmitted to the pen by the system of levers shown. The second pen is at a fixed height, and draws a standard line upon the paper, so that there may be no doubt whether the chart has been correctly adjusted on the cylinder. There is only one point of difficulty: that is with regard to the application of a correction for temperature, and on this Mr. Dines has kindly supplied the following explanation:—

In a self-recording barometer when the pen is actuated by a float in the lower cistern it is easy to apply a temperature compensation, and the convenience of doing away with the necessary correction is well worth the small additional expense.

In cases where the barometer consists of an upper and a lower cistern connected by a smaller tube, the effect of a rise of temperature is to lower the level in the bottom cistern and to raise it in the upper one. The volume of mercury in the connecting tube being small, its expansion with heat has but a trifling effect upon the level in the cisterns, but owing to its decreased density, a longer column is required to balance the air pressure, and this is obtained by the mercury sinking in the lower and rising in the upper cistern. Compensation can be obtained by any plan that will raise the mercury in the cistern, or raise the float in the mercury, when the temperature rises. Either effect is easily produced. If the vacuum chamber be a large one, and sufficient air to produce a few tenths of an inch pressure be left in it, compensation by the raising of the mercury level can be obtained; and the sizes being given, the calculation of the pressure that must be left presents no difficulty.

It is perhaps more convenient to employ a float containing air, the expansion of which raises the level at which the float swims in the mercury. An inverted iron cylinder hermetically sealed at the top and floating mouth downwards serves the purpose. The length of the column of enclosed air that must be left can be obtained by calculation, and a syphon trap can be arranged which affords an exit for the air until the desired amount is left, the trap being then sealed by the mercury. An increase of temperature reduces the density of the mercury in the barometer tube, and hence lowers the level in the bottom cistern, but at the same time it expands the air in the float, and if the correct amount has been left, the total result is that there is no change in the position of the float. Of course the compensation is not theoretically perfect, since the expansion of mercury per degree is practically constant, whereas the expansion of air varies as the absolute temperature — *i.e.*, the temperature measured from —460° F., but for all practical purposes the difference is inappreciable. The height at which the float swims is also influenced by the barometric pressure prevailing at the time, since this also alters the volume of the enclosed air, but the result is only a small alteration in the magnitude of the scale.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE WETTEST SPOT IN THE UNITED KINGDOM.

WITH regard to the suggestion made by Mr. Gethin-Jones in his interesting and lucid article of last month, on the wettest spot in Wales, that there may be places among the mountains of south-west Ireland possessing a higher mean annual rainfall than the Stye Head Pass, this may, of course, prove to be the fact, but it is scarcely likely to prove so, inasmuch as Cumberland lies farther into the low-pressure region of the north Atlantic than Kerry, with the consequence that during the westerly type of weather which so often prevails over the United Kingdom, a cyclonic system, situated to the north of these islands, which may be causing a deluge in Scotland and northern England, will occasion a more moderate rainfall in the south of Ireland, and perhaps only a few passing showers in the south of England. We are so accustomed to associate the distribution of rainfall in this country with the relief of the land, that we are apt to overlook the fact that some regions experience the full influence of a greater number of cyclonic systems in the course of a year than others.

The exaggerated difference between the mean annual rainfalls of two such places, for example, as the Stye Head Pass and Hampstead Heath, though primarily due to the situation of the former place in the heart of the Cumbrian mountains, is also, in some measure, to be accounted for by the fact that Middlesex is spared the ravages of a greater number of cyclones in the course of a year than Cumberland. In the relatively cold climate of England the bulk of the rain which falls is occasioned by powerful external causes, like cyclones (the actual amount of precipitation being, of course, enormously increased in the mountainous districts), and even in the south-east of England, where the summers are warmer than in any other part of Britain, the thunder rains of local origin are not remarkably pronounced, either in frequency or intensity; whereas in northern Italy, where thunder and hail storms of great severity are at times in summer of almost daily occurrence, three or four inches of rain in twenty-four hours is no unusual amount; in London the fall during the same period very rarely exceeds two inches. Thus the "home-made" summer rains of Britain that show such a tendency to develope about 3 p.m., on sultry days, are quite insignificant compared with the enormous autumn and winter precipitation of the mountainous districts of the north and west. The wettest spot in the British Isles, be it in Kerry, Carnarvon, Cumberland, Argyll or Skye, will obviously be found on the leeward side of

some mountainous mass, which, situated in a district influenced by a large number of rainy atmospheric depressions, is able to enhance in the most efficient manner the upward movement of the moisture-laden winds which strike against it.

L. C. W. BONACINA.

BALL LIGHTNING.

I ONCE saw ball lightning during a heavy thunderstorm at Aber, N. Wales, on 21st August, 1898. I was sitting with a friend in the porch of the Railway Hotel, watching the storm, when, at about 10 p.m., a brilliant flash revealed small balls of fire along a low line of clouds. The effect, though of course instantaneous, was very pretty.

C. S PRINGLE.

Whitekirk, Southbourne, Hants, August 17th, 1904.

[The appearance described by Mr. Pringle is well-known, but is not the phenomenon usually described as ball lightning. The question in dispute is whether lightning in the form of a ball of fire enters a house or rolls along the ground, and finally bursts in a manner capable of doing damage.—ED. *S.M.M.*]

A SHARP thunderstorm was experienced here on the 22nd inst., between 11.30 a.m. and noon. After a loud peal of thunder, a ball of light of a molten glowing yellow colour became visible in the S.E. at 11.40 a.m. The ball was estimated to be about $\frac{1}{2}^\circ$ in diameter, and appeared about 5° above the surface of the sea. To the top of the ball was attached a narrow, pear-shaped appendage, extending upwards about $1\frac{1}{2}^\circ$. The ball remained visible for nearly five seconds, when it was swallowed up in a dense blue-black mist, which hung over the sea during the storm. The cumulus clouds in the early morning were remarkable for their immense size and strong electrical appearance.

SPENCER C. RUSSELL.

Dawlish, S. Devon, August 27th, 1904.

[At the time when this interesting discussion is going on in these pages, the above recent observation of the phenomenon cannot fail to be of interest.]

FORMATION OF A WATER SPOUT.

I WISH to direct your attention to a meteorological phenomenon that delighted me for a short time last Tuesday, near midday. As I travelled by train from Harrogate to Lancaster, when less than an hour from the latter place, I noticed a large cumulus cloud in the west, apparently moving slowly in an easterly direction; it was ragged below, dark and smooth-like near the middle. From what I could estimate it may have been 30 or 40 miles distant, and about

30° in depth. From about 7° or 8° above the lower edge there was distinctly seen a water spout. This soon extended down to a jagged edge of the cloud, then trailed down in front of sky with only thin whitish cloud, or with none. It soon attained a length of 7° or 8°, then it departed gradually from the perpendicular until it was finally seen as a slightly irregular tube at an angle of about 60° to 70°, the upper, attached end, travelling faster than the lower part. It must, after ten minutes, have attained a length of something like 10°, but it lengthened by assuming the form of a rat's tail, as if spun out, the lower part ending in a fine tapering point. When greatly attenuated, it broke into dissolving fragments. It was longer and thinner than any spout I ever saw in the tropics. The whole phenomenon may have lasted about a quarter of an hour.

I hope a number of holiday seekers may have levelled their kodaks on it.

W. MacGREGOR.

Waverley Hotel, Edinburgh, August 25th, 1904.

[We are greatly indebted to His Excellency Sir William MacGregor, the new Governor of Newfoundland, for the graphic description given above, and we hope that if a photograph of the phenomenon was secured by any fortunate observer we may be favoured with a copy of it.—Ed. *S.M.M.*]

HEAVY RAIN ON AUGUST 22nd.

The rainfall of Monday, August 22nd, amounted to exactly 2 inches. A thunderstorm came up from the south, rain beginning at 2 p.m., by 4.30 rain had ceased, 1·33 in. having fallen. Rain fell at intervals through the evening, and another short thunderstorm occurred from 8 to 8.30 p.m. The afternoon storm was quite local, and no rain fell at Witham till 4 p.m., while the rain here was heaviest about 3 p.m., accompanied by two short falls of hail.

H. C. BOUTFLOWER.

Terling Vicarage, Witham, August 29th, 1904.

METEOROLOGICAL NEWS AND NOTES.

The Austrian Meteorological Society has received from the Emperor of Austria the right to use the letters "K.K.," equivalent to Royal Imperial, before its name, so that its official designation now becomes the "k.k. Oesterreichische Gesellschaft für Meteorologie." This Society and the German Meteorological Society are jointly responsible for the *Meteorologische Zeitschrift* so ably edited by Drs. Hann and Hellmann.

THE EIGHT MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—August, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	14·44	103	Arncliffe	40·02	107	Braemar	18·31	88
Tenterden	16·36	101	Hull	16·11	105	Aberdeen	18·56	96
Hartley Wintney	17·11	112	Newcastle.....	16·36	102	Cawdor	15·69	83
Hitchin	15·92	112	Seathwaite ...	85·76	109	Glencarron ...	54·71	98
Winslow	16·61	115	Cardiff	29·67	127	Dunrobin	18·69	101
Westley.....	15·08	97	Haverfordwest	26·96	109	Killarney ...	35·50	107
Brundall.....	13·97	91	Gogerddan ...	29·69	116	Waterford ...	29·07	120
Alderbury	19·95	123	Llandudno ...	18·69	108	Broadford.....	26·75	128
Ashburton	37·30	131	Dumfries	27·28	103	Carlow	23·43	111
Polapit Tamar ...	30·24	142	Lilliesleaf	21·79	117	Dublin	16·82	98
Stroud	20·27	121	Colmonell	27·12	104	Mullingar.....	24·20	104
Woolstaston	20·11	113	Glasgow	24·25	110	Ballinasloe ...	27·21	119
Boston	13·76	110	Inveraray	45·37	107	Clifden	56·52	116
Hesley Hall	15·90	122	Islay	32·05	122	Crossmolina ...	42·56	137
Derby.....	15·05	105	Mull	39·11	117	Seaforde	24·59	110
Bolton	23·10	91	Loch Leven ...	24·72	112	Londonderry..	28·47	112
Wetherby	20·26	137	Dundee	19·25	114	Omagh	30·12	124

The fairly normal character of the rainfall during August, especially over England and Wales, leaves the general distribution of the areas of excess and deficiency very similar to that shown in the aggregate table ending July. The excess of rainfall accumulated in the early months of the year was to some extent neutralized by the dryness of June, and in a lesser degree July, but the percentages generally speaking are in the present table again showing a slight increase. Certain individual stations have been more disturbed, notably in the case of Dundee, which from a deficit of 3 per cent. at the end of July had advanced to an excess of 14 per cent. by the end of August. The south-west of England remains relatively the wettest part of the United Kingdom, but with slightly reduced values. The north-east of Scotland also maintains its position as the driest portion of our islands, though the area is probably somewhat reduced. The only other parts of the British Isles reporting a deficiency are the east of England and isolated patches in the neighbourhood of Bolton and Dublin, the deficit in the last-named instance being so small as to be almost negligible. Compared with the corresponding period of 1903 only three stations in the present table give values exceeding that year, one being in the south-west of England and two in the west of Ireland, and taking the country as a whole the value is found to be 111 per cent. of the average as against 139 per cent. in 1903, the average used being that for the decade 1890-99, which, it should be borne in mind, is considerably lower than the mean for a longer period.

RAINFALL AND TEMPERATURE, AUGUST, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL.				Days on which ·01 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours.			Max.		Min.		Shade	Grass
				Depth	Date.		Deg.	Date.	Deg.	Date.		
		inches	inches.	in.								
I.	London (Camden Square) ...	1·59	— ·51	·75	31	10	91·0	4	44·3	21	0	0
II.	Tenterden ...	1·18	— 1·26	·54	31	11	87·0	4	43·5	21	0	0
,,	Hartley Wintney ...	2·04	— ·31	·72	31	8	85·0	3, 4	39·0	26	0	0
III.	Hitchin	2·51	+ ·38	1·08	31	12	85·0	4	42·0	20	0	...
,,	Winslow (Addington) ...	2·68	+ ·55	1·00	31	11	87·0	4	37·0	25	0	0
IV.	Bury St. Edmunds (Westley)	2·67	+ ·27	1·54	31	10	87·0	4	40·0	25	0	...
,,	Brundall	2·17	— ·20	·59	21	13	87·6	4	42·0	21	0	0
V.	Alderbury ...	2·49	+ ·28	·53	22	13	79·0	3	39·0	24	0	...
,,	Winterborne Steepleton ...	3·82	...	·62	16	17	77·8	3	39·4	13	0	0
,,	Torquay (Cary Green) ...	2·87	...	·76	16	14	76·5	4	48·0	21, 24	0	0
,,	Polapit Tamar [Launceston]	2·32	— 1·02	·44	21	16	75·7	3	36·0	24	0	0
,,	Bath ...	2·82	...	·59	22	14	82·0	3	40·2	25	0	2
VI.	Stroud (Upfield) ...	2·80	+ ·26	·81	21	17	82·0	3	44·0	24	0	...
,,	Church Stretton (Woolstaston)	3·19	+ ·35	·70	3	16	78·0	3	42·0	23	0	...
,,	Bromsgrove (Stoke Reformatory)	1·62	+ ·33	·45	3	12	81·0	3	35·0	24	0	...
VII.	Boston ...	1·75	— ·20	·54	11	11	87·0	...	41·0	...	0	...
,,	Bawtry (Hesley Hall) ...	2·91	+ ·70	1·21	17	13	85·0	4, 5	51·0	23	0	...
,,	Derby (Midland Railway)...	2·67	+ ·55	1·00	17	15	88·0	3	41·0	24	0	...
VIII.	Bolton (The Park) ...	4·64	+ ·16	·72	22	22	80·2	3	43·2	21	0	0
IX.	Wetherby (Ribston Hall) ...	3·75	+ 1·48	1·13	17	16	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	5·76	+ ·27	·97	17	24	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	3·28	+ ·66	1·24	17	19	84·0	3	38·0	21	0	0
X.	Newcastle (Town Moor) ...	2·59	— ·32	·90	22	19	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	11·09	— ·31	2·00	14	22	76·5	29	36·0	21	0	...
XI.	Cardiff (Ely)	3·47	— ·70	·63	22	21	...	...	...	...	...	..
,,	Haverfordwest (High St.)...	2·93	— ·73	·90	12	10	83·6	10	40·2	8	0	0
,,	Aberystwith (Gogerddan)..	6·86	+ 2·91	1·60	16	16	87·0	24	30·0	17	1	...
,,	Llandudno ...	3·26	+ ·46	·70	21	17	78·0	4	45·0	25	0	...
XII.	Cargen [Dumfries] ...	3·84	— ·30	·84	13	16	77·0	30	37·0	21	0	...
XIII.	Edinburgh (Royal Observy.)	4·30	...	1·15	17	18	75·1	4	42·5	21	0	0
XIV.	Colmonell ...	5·81	+ 1·82	1·65	10	19	75·0	30	38·0	23	0	...
XV.	Tighnabruaich ...	5·03	...	·67	10	21	66·0	30	40·0	22*b*	0	0
,,	Mull (Quinish) ...	5·84	+ ·72	·88	3	22	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	5·69	+ 2·03	·79	5	21	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	5·55	+ 2·74	1·40	4	24	77·7	4	41·9	20	0	...
XVII.	Braemar ...	3·73	+ ·06	·72	4	21	72·0	4	34·0	25	0	6
,,	Aberdeen (Cranford) ...	2·31	— ·99	·31	6	22	77·0	29	36·0	24	0	...
,,	Cawdor (Budgate)	4·04	+ ·89	·79	4	24	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	9·27	+ ·73	1·36	6	28	77·6	30	36·5	25	0	...
,,	Bendamph ...	7·10	+ ·38	1·09	13	25	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	3·03	+ ·48	·65	13	20	69·0	4	38·0	25	0	...
,,	Castletown ...	3·06	...	·59	13	28	76·0	3	36·0	25	0	0
XX.	Killarney ...	4·02	— 1·30	·82	14	19	76·0	30	41·5	24	0	...
,,	Waterford (Brook Lodge)...	4·18	+ ·25	·74	30	17	69·5	4	40·6	16	0	...
,,	Broadford (Hurdlestown) ...	4·24	+ ·66	·64	3	23	68·0	29*a*	42·0	22, 23	0	...
XXI.	Carlow (Browne's Hill) ...	4·10	+ ·67	·86	21	18	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	2·90	— ·06	·90	30	18	77·7	3	44·6	24	0	0
XXII.	Ballinasloe ...	4·82	+ ·89	1·34	1	25	74·0	30	39·0	16	0	...
,,	Clifden (Kylemore House)..	6·63	— 1·27	1·25	5	22	...	...	...	...	...	...
XXIII.	Seaforde ...	4·73	+ 1·43	1·02	10	22	79·0	5	43·0	22	0	0
,,	Londonderry (Creggan Res.)	7·33	+ 2·91	1·05	30	25	...	...	...	...	...	...
,,	/ *Omagh (Edenfel)* ...	5·37	+ 1·13	·96	10	24	73·0	30	41·0	22	0	0

+ Shows that the fall was above the average; — that it was below it. a and 30, 31. b and 23, 24.

SUPPLEMENTARY RAINFALL, AUGUST, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	2·09	XI.	New Radnor, Ednol	3·68
,,	Sheppey, Leysdown	2·18	,,	Rhayader, Nantgwillt	3·86
,,	Hailsham	2·00	,,	Lake Vyrnwy	5·61
,,	Crowborough	1·69	,,	Ruthin, Plâs Drâw	3·78
,,	Ryde, Beldornie Tower	2·38	,,	Criccieth, Talarvor	3·91
,,	Emsworth, Redlands	2·95	,,	Anglesey, Lligwy	2·74
,,	Alton, Ashdell	2·88	,,	Douglas, Woodville	4·21
,,	Newbury, Welford Park	3·10	XII.	Stoneykirk, Ardwell House	4·76
III.	Harrow Weald	2·17	,,	Dalry, Old Garroch	7·88
,,	Oxford, Magdalen College	1·48	,,	Langholm, Drove Road	5·63
,,	Banbury, Bloxham	1·77	,,	Monaive, Maxwelton House	5·74
,,	Pitsford, Sedgebrook	3·18	,,	Lilliesleaf, Riddell	2·85
,,	Huntingdon, Brampton	1·31	XIII.	N. Esk Reservoir [Penicuick]	4·50
,,	Wisbech, Bank House	2·08	XIV.	Maybole, Knockdon Farm	4·90
IV.	Southend	1·80	,,	Glasgow, Queen's Park	3·45
,,	Colchester, Lexden	1·20	XV.	Inveraray, Newtown	7·41
,,	Saffron Waldon, Newport	2·46	,,	Ballachulish, Ardsheal	8·12
,,	Rendlesham Hall	·83	,,	Campbeltown, Redknowe	4·97
,,	Swaffham	3·38	,,	Islay, Eallabus	5·41
,,	Blakeney	1·63	XVI.	Dollar	5·61
V.	Bishop's Cannings	2·96	,,	Balquhidder, Stronvar	7·74
,,	Ashburton, Druid House	3·40	,,	Coupar Angus Station	4·34
,,	Okehampton, Oaklands	2·99	,,	Blair Atholl	4·13
,,	Hartland Abbey	3·06	,,	Montrose, Sunnyside	4·19
,,	Lynmouth, Rock House	2·99	XVII.	Alford, Lynturk Manse	3·04
,,	Probus, Lamellyn	2·40	,,	Keith, H.R.S.	5·14
,,	Wellington, The Avenue	2·76	XVIII.	Fearn, Lower Pitkerrie	3·36
,,	North Cadbury Rectory	3·27	,,	S. Uist, Askernish	...
VI.	Clifton, Pembroke Road	3·23	,,	Invergarry	4·53
,,	Moreton-in-Marsh, Longboro'	2·67	,,	Aviemore, Alvie Manse	3·67
,,	Ross, The Graig	1·77	,,	Loch Ness, Drumnadrochit	3·28
,,	Shifnal, Hatton Grange	2·75	XIX.	Invershin	3·68
,,	Wem Rectory	4·60	,,	Altnaharra	2·17
,,	Cheadle, The Heath House	4·86	,,	Bettyhill	4·98
,,	Coventry, Kingswood	1·69	,,	Watten, H.R.S.	2·87
VII.	Market Overton	2·08	XX.	Cork, Wellesley Terrace	2·97
,,	Market Rasen	5·62	,,	Darrynane Abbey	4·78
,,	Worksop, Hodsock Priory	3·45	,,	Glenam [Clonmel]	3·53
VIII.	Neston, Hinderton	4·18	,,	Ballingarry, Hazelfort	3·58
,,	Southport, Hesketh Park	3·10	,,	Miltown Malbay	6·01
,,	Chatburn, Middlewood	6·58	XXI.	Gorey, Courtown House	2·77
,,	Duddon Valley, Seathwaite Vic.	5·15	,,	Moynalty, Westland	3·67
IX.	Langsett Moor, Up. Midhope	...	,,	Athlone, Twyford	5·26
,,	Baldersby	3·04	,,	Mullingar, Belvedere	2·88
,,	Scalby, Silverdale	3·44	XXII.	Woodlawn	4·39
,,	Ingleby Greenhow	3·43	,,	Westport, Murrisk Abbey	5·47
,,	Middleton, Mickleton	2·80	,,	Crossmolina, Enniscoe	6·98
X.	Beltingham	...	,,	Collooney, Markree Obsy	6·05
,,	Bamburgh	...	XXIII.	Enniskillen, Portora	4·35
,,	Keswick, The Bank	5·14	,,	Warrenpoint	5·74
,,	Melmerby Rectory	3·30	,,	Banbridge, Milltown	5·77
XI.	Llanfrechfa Grange	3·13	,,	Belfast, Springfield	4·90
,,	Treherbert, Tyn-y-waun	6·52	,,	Bushmills, Dundarave	5·52
,,	Llandovery, Tonn	3·42	,,	Stewartstown	5·22
,,	Castle Malgwyn	2·85	,,	Killybegs	4·81
,,	Llandefaelog-fach	3·13	,,	Horn Head	4·51

METEOROLOGICAL NOTES ON AUGUST, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Changeable and never settled for more than a few days together. Hot weather during the first and last weeks. The R was of little consequence until the last day, and little T or L occurred. Duration of sunshine 199·6 hours,* and of R 31·5 hours, of which 15·5 hours occurred on 31st. Mean temp. 62°·6, or 0°·5 above the average.

ABINGER HALL.—Dry, with cold nights. R was much needed and grass lands very brown and dried up. The fall on the 31st was most welcome.

TENTERDEN.—Very dry till 31st. Several hot days in the first and last weeks. High wind on 14th and 15th, doing great damage to hops and fruit. Pastures much burnt up.

CROWBOROUGH.—The first four days were very warm, but the remainder cooler and very pleasant. R much below the average.

HARTLEY WINTNEY.—A perfect summer month, beautiful R alternating with lovely sunshine. Absence of T, and clear warm nights. Ozone on 15 days with a mean of 3·5.

PITSFORD.—A pleasant month, excellent for harvest operations. A considerable amount of wind. R 1·31 in. above the average. Mean temp. 59°·0.

COLCHESTER.—Dry, with much sunshine and several hot days. Cool from 11th to 25th.

BURY ST. EDMUNDS.—Very hot and dry till the last day, when 1·54 in. of R fell. Splendid for the harvest, which was completed in first-rate condition.

BRUNDALL.—Hot and dry at first, followed by a cool and unsettled period, with some sharp TS. Splendid weather in the last week with increased heat, breaking into T and R again at the close. Mean temp. 0°·3 above the average.

TORQUAY.—R ·20 in. above the average. Duration of sunshine 233·2 hours* or 27·5 hours above the average. Mean temp. 60°·7 or 0°·9 below the average. Mean amount of ozone 4·5. Max. 7·0 on 18th, with W.N.W. wind; min. 2·0 on 5th, with S.W. wind.

POLAPIT TAMAR.—Generally very seasonable, though the night temp. was low.

NORTH CADBURY.—Good summer weather for the first ten days; after that cool, showery and autumnal, with never more than three fine days together and R well above the average.

ROSS.—Generally very fine but frequent slight showers. No heavy storms. R below the average, but temp. normal, being highest in the first and last weeks. Harvest, both hay and corn, was almost all secured in excellent condition.

WORKSOP.—Fine, except for heavy R between 17th and 23rd. Harvest was about finished by the end of the month.

BOLTON.—On the whole favourable for agriculture. The mean temp., 56°·2, was 0°·4 below the average, and the R just about normal. Duration of sunshine 150·8 hours* or 25·9 hours above the average. From 1st to 5th, and again from 28th to 30th, the mean temp. exceeded 60° for the first time in August since 1899. Nearly all the harvest was gathered in excellent condition.

SOUTHPORT.—A fairly normal month, bar. pressure being, however, rather high. Mean temp. 0°·1 below, duration of sunshine 7 hours below, and R ·67 in. below, the average.

HULL.—After the passing of the heat wave some unsettled weather ensued, lasting till 25th, when it became hot again till the end. Duration of sunshine 161·3 hours. On 17th 1·24 in. of R fell in 14 hours.

LLANFRECHFA GRANGE.—Wheat ripened early and well, and most of the harvest was secured during the month.

LLANDOVERY.—Changeable temp. and weather. Only two days without sun, but 11 without R. R about the average.

HAVERFORDWEST.—Fine and warm during the first 8 days, then cooler till 22nd when the max. only reached 58°·6; warmer to the end. The temp. reached 70° on 8 days during the month.

DOUGLAS.—On the whole better than the normal. There were a few warm days, reaching 70°, early in the month and towards the close; otherwise generally cold. Severe gale on 6th, and strong winds on 8 days.

SCOTLAND.

LANGHOLM.—R ·23 in. above the average of 28 years.

MAXWELTON HOUSE.—Fine and warm. A heavy hay crop was well got in, and there was plenty of grass and aftermath.

LILLIESLEAF.—Cold and rainy up to the last three days. R ·06 in. above the average. Crops were looking well but backward, owing to the small amount of sunshine. Harvest not commenced.

COLMONELL.—Generally wet, with frequent strong winds. H, T and L on 22nd.

INVERARAY.—On the whole very pleasant weather, but not warm except on one or two days.

QUINISH.—Very warm and much finer than the total R indicates, as it fell heavily and was soon over.

COUPAR ANGUS.—The first and last weeks were warm and the middle cold. Mean temp. 55°·9, or equal to the average. R an inch above the average. Two TSS.

DRUMNADROCHIT.—R ·36 in., and rainy days 5, above the average of 18 years.

WATTEN.—Cloudy, mild and fine, with light R and no flooding. A month of fine growing weather.

CASTLETOWN.—Warm and damp throughout with occasional bursts of bright, warm sunshine and drying winds, giving an opportunity for securing hay crops. On the morning of the 30th ·16 in. of R fell in 15 minutes. There was a scarcity of water in village wells from August 12th to September 3rd.

IRELAND.

CORK.—R ·52 in. less than the average and mean temp. 3°·5 below the average.

DARRYNANE.—A tolerably good month with some fine hot days. R slightly above the average.

MILTOWN MALBAY.—The first half was warm, with much R; the second more sultry, with less R, but on the whole a rainy month.

DUBLIN.—Showery, but very favourable, with frequent high day temp., the max. rising to 70° or upwards on 9 days. Gales on four days; TS on 17th. Duration of sunshine 186·5 hours.

MARKREE OBSERVATORY.—Very bad weather throughout, even worse than in 1903. R fell on 25 days, at times very heavily, with strong winds.

OMAGH.—This year formed no exception to the typical wetness of the "Lammas" period, for from July 18th to August 18th R fell more or less heavily on every day but two, 7·47 in. in all; but probably the excess of wet was attended with less damage and discomfort than the abnormal drought prevalent at so many English and continental stations during the same period.

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* Campbell-Stokes.

Climatological Table for the British Empire, March, 1904.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	61·0	9	27·9	17	47·9	34·5	36·5	87	96·4	20·9	1·72	15	7·0
Malta	69·8	17	44·3	5	63·1	51·5	47·4	72	119·8	38·9	1·40	6	3·7
Lagos, W. Africa	92·0	10	71·5	28	88·0	74·6	74·3	71	148·0	68·5	7·04	9	5·3
Cape Town	96·6	20	42·5	31	76·4	58·2	55·4	68	...	...	·40	7	3·9
Durban, Natal	88·4	26	61·6	19	82·2	66·5	...	...	143·3	...	4·87	15	5·4
Mauritius	87·3	14	67·8	6	83·3	71·9	70·1	80	154·2	60·8	13·21	22	7·1
Calcutta	100·0	28	61·9	12	92·1	69·4	64·6	62	153·6	58·4	2·62	4	1·6
Bombay	94·7	30	69·4	11	86·7	73·5	69·1	71	141·2	60·1	·07	1	1·2
Madras	93·3	20	67·7	10	88·2	70·0	69·7	76	143·0	63·8	·00	0	1·2
Kodaikanal	72·1	20	47·2	1	69·6	50·4	38·0	45	139·6	34·5	·04	1	2·4
Colombo, Ceylon	91·0	5	71·6	11	88·3	74·2	71·8	77	153·2	68·2	6·34	5	3·2
Hongkong	78·6	27	52·2	19	67·0	60·3	59·7	87	122·9	...	3·76	15	9·7
Melbourne	79·2	31	41·7	24	68·3	52·7	52·3	78	141·9	33·4	·95	8	6·6
Adelaide	96·2	14	51·0	8	78·5	56·9	49·2	53	144·6	45·4	·40	4	4·3
Coolgardie	97·6	24	51·4	21*a*	81·2	57·4	49·0	48	164·0	47·2	·80	4	3·6
Sydney	78·4	16	57·8	28	72·8	61·6	58·8	78	121·9	49·1	5·02	23	5·8
Wellington	73·4	10	47·0	26*b*	66·3	54·6	41·2	50	132·0	42·5	9·94	17	7·2
Auckland	75·0	6	50·5	20	69·5	53·8	56·1	76	141·0	45·0	7·33	14	5·6
Jamaica, Negril Point	87·3	17	64·1	9	83·5	67·1	68·5	80	...	...	2·59	10	...
Trinidad	89·0	14	72·0	13	85·2	66·3	70·9	86	166·0	59·0	4·24	15	...
Grenada	84·6	11	69·4	22*c*	81·7	70·9	69·4	76	150·2	...	4·40	19	3·9
Toronto	50·7	25	4·2	4	35·4	22·0	24·7	80	101·7	—2·0	2·92	17	3·6
Fredericton	51·8	26	— 9·7	5	39·1	14·0	13·5	56	...	...	4·79	14	5·4
Winnipeg	42·5	30	—23·5	26	23·3	2·2	...	...	...	...	3·00	12	5·5
Victoria, B.C.	52·0	31	27·8	1	45·2	36·8	...	...	...	...	3·62	20	8·0
Dawson	38·0	26	—38·8	4	10·0	—15·1	...	...	...	...	2·00	2	3·9

a and 22. *b* and 27 *c* and 24

MALTA.—Mean temp. of air 56°·7 or 0°·9 above, mean hourly velocity of wind 10·9 miles or 1·1 below, averages. Mean temp. of sea 61°·0. TS8 on 3 days.

Mauritius.—Mean temp. of air 1°·4 below, dew point 0°·4 below, and R 4·84 in. above averages. Mean hourly velocity of wind 11·1 miles or 0·7 below average; extremes, 44·2 on 21st and 1·7 on 24th.

MADRAS.—Bright sunshine 271·2 hours, or 72·9 per cent. of possible.

KODAIKANAL.—Bright sunshine 264 hours.

COLOMBO.—Mean temp. 81°·7 or 0°·3 below, dew point 1°·1 below, and R 1·59 in. above, averages. Mean hourly velocity of wind 6 miles; prevailing direction S.W.

HONGKONG.—Mean temp. of air 63°·2. Bright sunshine 29·7 hours. Mean hourly velocity of wind 14·6 miles.

Adelaide.—Mean temp. of air 2°·7 below, R ·67 in. below, averages.

Sydney.—Mean temp. 2°·1 below, humidity 2·8 above, and R ·08 in. below, averages.

Wellington.—Mean temp. of air 1°·3 above, R 7·99 in. above, averages.

Auckland.—Mean temp. of air about the average, and R more than three times the average. Heavy gale on 19th.

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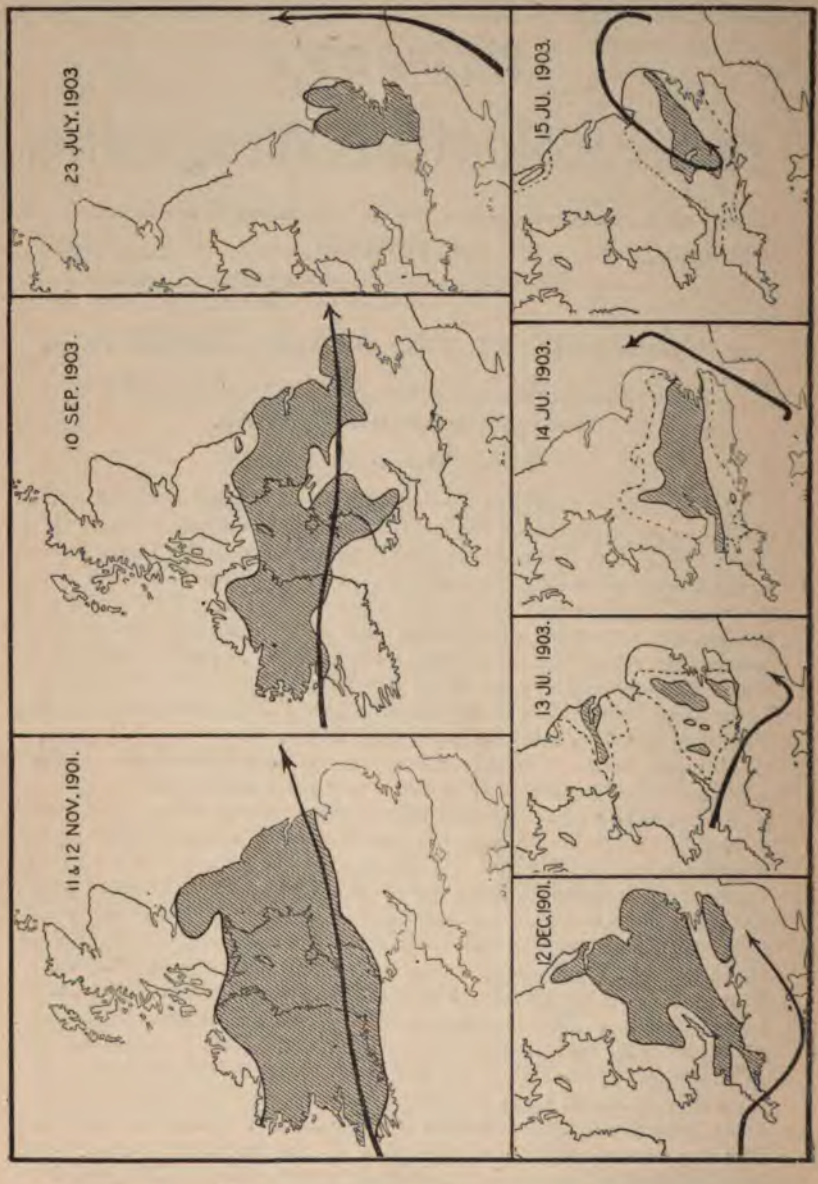
METEOROLOGY AT THE BRITISH ASSOCIATION.

On the Unsymmetrical Distribution of Rainfall about the Path of a Barometric Depression.

By Hugh Robert Mill, D.Sc.

In the course of studying the distribution of rainfall for publication in the annual volumes of *British Rainfall* much attention has always been paid to individual days on which heavy rain fell. These heavy rains are divisible into two categories, which for convenience may be termed Thunderstorm Rains and Cyclonic Rains. The former are typically of irregular distribution and short duration, the rainfall sometimes exceeding 3 inches in a single hour in patches separated by stretches of country where no rain falls. The latter are typically of uniform distribution over wide areas, with falls sometimes exceeding 3 inches in 24 hours, but rarely falling at a rate greater than ·50 in. per hour. Cyclonic rains are characteristic of the winter months, although they may occur at any time of the year.

Ten instances of severe and widespread cyclonic rains have been investigated by the author. The method adopted was to plot upon a map the rainfall for the day in question (9 a.m. to 9 a.m.) at all stations for which the figure was available and then to draw lines limiting the areas within which the falls exceeded ·50, 1·00, 2·00, 3·00, and 4·00 inches respectively. No cases were investigated in which there was not a considerable area with more than one inch of rain. The number of points from which the map was drawn varies from a few hundred to 2000 or more, according to the extent of surface affected. The maps, reduced to a small scale, have been published in *British Rainfall* during the last four years. The position of the lines may be relied upon as correct on the scale shown, the probable error lying in most cases within the thickness of the lines as drawn. For the present discussion the path of the barometric depression associated with the rain is added from the monthly summary of the *Weekly Weather Report* of the Meteorological Office.


23 JULY. 1903
15 JU. 1903.
10 SEP. 1903.
14 JU. 1903.
11 & 12 NOV. 1901.
13 JU. 1903.
12 DEC. 1901.

In the ten maps prepared the path of the depression was directed towards different points of the compass. The positions of the centre are marked for the hours of observation from 8 a.m. on one day to 8 a.m. on the next, thus corresponding very closely with the rainfall day, 9 a.m. to 9 a.m. Seven of these are reproduced in the accompanying maps.

The ten cases include two in which the centre described a path nearly from S. to N.

(1) *27th October, 1903.*—Path from the Lizard along the eastern border of Wales to the Solway. The area with rainfall over one inch extended from S. to N., reaching considerably beyond the position of the centre at 9 a.m., and a larger area, though perhaps not a greater volume of rain, lay to the right of the track than on the left. This is the only instance of the kind in the ten cases.

(2) *23rd July, 1903.*—The centre travelled north eastward from near Ushant through France and passed into the North Sea northward from Holland. The area with more than one inch of rain extended due north from the coast of Sussex and Kent to the Wash, and in the centre the falls exceeded 3 and at some points 4 inches. The whole wet area lay well to the left of the path. (See map).

In two cases the path was first directed towards the S.E. and curved round to N.E.

(3) *12th December, 1901.*—At 8 a.m. on the 12th the centre was in the Bristol Channel, at 6 p.m. in the English Channel south of the Start, and at 8 a.m. on the 13th south of Selsey Bill. The rainfall exceeded an inch from Cornwall to Kent on the south-east and to the Tees on the north-east, the whole lying well to the left of the path. (See map).

(4) *8th October, 1903.*—The centre at 8 a.m. was on the coast of Cardigan, at 6 p.m. near Oxford, and at 8 a.m. on the 9th out in the North Sea in the latitude of Flamborough Head. The rainfall exceeded an inch in the eastern half of Great Britain from the Humber to the Forth, and exceeded 3 inches on the coast of Northumberland. The whole wet area lay on the left of the path.

Two cases in which the path was nearly straight from W. to E.

(5) *11th and 12th November, 1901.*—The centre was near Valencia on the 11th, about Tipperary at 8 a.m. on the 12th, to the south of Carnarvon at 6 p.m., and in the North Sea off Grimsby at 8 a.m. on the 13th. Falls exceeding an inch prevailed over Ireland, western Wales and north-western England on the 11th, and over north-eastern Ireland, northern England, and southern Scotland on the 12th, extending on each day from 150 to more than 200 miles to the left of the path, but on neither day more than 50, and rarely more than 25, miles to the right. (See map).

(6) *10th September, 1903.*—This storm will be remembered by visitors to the British Association at Southport. The path ran Clare to Norfolk, the centre was off the Arran Islands on the 10 2 p.m., south of Carnarvon at 6 p.m., and in the middle of the N

Sea at 8 a.m. on the 11th. This centre crossed the British Isles in about 16 hours, while No. 5 required at least 30 hours; but although the centre moved more quickly, the area over which an inch or more of rain fell was not much smaller. It extended for about 130 miles to the left of the path, and, except for a narrow strip along the coast of Wales, only for from 5 to 30 miles to the right of the path. (See map). If the paths of the two depressions Nos. 5 and 6 are superimposed to allow for the slight difference in direction, the similarity of the broad, wet strip to the left and the narrow wet strip to the right is most striking.

Three consecutive days in June, 1903, showed remarkable features.

(7) *13th June, 1903.*—The path ran from the Bristol Channel to the Isle of Wight, and at 8 a.m. on the 14th was close to the French coast and turning northwards. The whole area of rainfall over half-an-inch lay to the left, and contained large tracts in the Thames basin, East Anglia and Sussex with more than an inch.

(8) *14th June, 1903.*—The centre turned north-eastward, passed through the Strait of Dover, and at 8 a.m. on the 15th it was in the North Sea off Yarmouth. A broad belt of rainfall exceeding one inch stretched across the whole of England from the Bristol Channel to the coast of Essex with patches where over two inches fell. This lay entirely to the left of the path.

(9) *15th June, 1903.*—The path suddenly curved round, and shortly after 6 p.m. the centre entered the Wash and passed south-westward across England, being near Southampton at 9 a.m. on the 16th, when it was curving eastward. This is a direction exactly opposite to that usual for cyclones crossing England; but, again, almost the entire extent of a large area with a rainfall exceeding one inch lay to the left of the path, *i.e.*, on the southern and eastern side, instead of on the northern and western side as in other cases.

During the three days in which this depression described an elliptic path round the lower Thames Valley and East Anglia, rain fell within that area continuously for about 60 hours, and amounted in that time to from 3 to 4 inches, producing a state of matters for which no precedent can be found. (See map).

One case remains.

(10) *30th December, 1900.*—The path ran from Cornwall through Portsmouth to the coast of France. The area with over an inch of rain stretched from the south coast to the Humber and Suffolk, and within it a large area had a fall exceeding 3 inches. So little of England lay south of the track that it is impossible to be quite sure, but the map certainly suggests that the greater part of the precipitation was on the left.

The conclusion drawn from the consideration of these instances is that *the belt of cyclonic rains is much wider on the left of the path than on the right, and the heaviest falls occur in advance of the centre.*

At present the fact is merely stated and the evidence collected during the last four years put forward. When more cases have been

investigated it should not be impossible to extend the conclusions, especially with regard to the parallelism or divergence of the wet belt with reference to the path, and perhaps, as a result, to improve the accuracy of regional forecasts. The interest of the question in the light of Dr. Shaw's discussion of the trajectories of the air in a cyclone is apparent. It is not known to the author with what degree of precision the position of the centre is given on the Meteorological Office charts, the paths shown were copied as accurately as possible from the official maps; but of course no allowance could be made for secondary depressions.

It is remarkable that the wide-spread cyclonic rains appear to bear no relation to the physical features of the country, however, the data are not yet sufficient to enable this question to be fully discussed.

Address to the Sub-Section Cosmical Physics,

By Sir John Eliot, K.C.I.E., M.A., F.R.S.

(*Continued from p. 147.*)

The preceding statements have shown that variations of rainfall for prolonged periods similar in character have occurred, and may hence occur again, over the very large area including the Southern Asian peninsulas, East and South Africa, Australia, and, perhaps, the Indian Ocean. The abnormal actions or conditions giving rise to these large and prolonged variations must hence be persistent for long periods, and be effective over the whole of that extensive area, and hence cannot be inferred with certainty from the examination of the data of one small portion of the area affected —*e.g.*, India. The variations undoubtedly accompany variations in the complete atmospheric circulation over the Indo-oceanic area, and the effective forces or actions must be such as to influence the whole movement in a similar manner in the two monsoons or seasons of inverse conditions in Southern Asia. This inference furnishes a very strong reason for the conclusion that the meteorology of the whole area similarly affected from 1892 to 1902 should be studied as a whole, and not in fragmentary detail by various weather bureaus, and as at present without any co-ordination of the results of these bureaus.

The discussion has also indicated that the south-west monsoon current is a periodic or intermittent extension of the permanent circulation of the south-east trades to the peninsulas of Southern Asia, and also that variations in the strength, volume, and direction of movement of the latter affect the extension, volume, aqueous vapour contents, and precipitation of the south-west monsoon currents in Burma, India, and Abyssinia. This fact further emphasises the necessity for the co-ordination and systematisation of the work of observation in the Indo-oceanic meteorological province and the continuous and systematic examination and discussion of observations for the whole of that area.

It is, of course, possible that it may be necessary to extend this work to a larger area than the Indo-oceanic region. For Sir Norman Lockyer and Dr. Lockyer have shown that similar pressure variations to those of Bombay

occur over a large portion of the Eastern Hemisphere, and variations of opposite sign (similar to those of Cordova) over a considerable part of the Western Hemisphere.

The Indian Meteorological Department, with the sanction of the Government of India, is now arranging to collect and tabulate data for the whole area between the Central Asian winter anticyclone and the permanent South Indian Ocean anticyclone, and to utilise the information for the investigation of the causes of the large and general variations of rainfall in Burma and India from year to year. This extension of its labour is recognised as necessary for the improvement of the seasonal forecasts, an important feature of the work of the Department, the value and importance of which are fully recognised by the Government of India.

Possibly the practice of the Indian Meteorological Department in the preparation and issue of long-period or seasonal forecasts is considered to be not only unscientific, but not justified by comparison with facts. Professor Cleveland Abbe, in his paper on "The Physical Basis of Long-range Weather Forecasts," expresses his opinion that "we are warranted in saying that during the thirteen years (1888—1900) the only real failure has been that of the prediction of the monsoon season of 1899, the year of phenomenally great drought in that country." This opinion is probably more favourable than I should myself give, but it is the opinion of an independent meteorologist eminently qualified to give a judgment in the matter.

My own opinion with respect to weather forecasts is that there appears to be too strong a desire for absolute accuracy, possibly due to public and newspaper criticism. Certainty is not possible in weather forecasts based on imperfect information, and in which the introduction of a single unknown factor in regions beyond observation—*e.g.*, the upper or middle atmosphere —may completely alter the course of events. Percentages of success are an inadequate measure of the utility of forecasts. To be of real value as estimates of utility they should be calculated rather on the information required, and which might be reasonably expected, than on that actually given.

It appears to me that the striving after perfection in short-period forecasts to the exclusion of other claims is impeding the extension and progress of meteorology in other useful directions. It is absolutely essential that officials preparing or utilising forecasts should recognise that every forecast is based on imperfect information and experience, and hence that all important forecasts should be expressed as probabilities, and, whenever desirable, an estimate of the value of each probability be given.

The Government of India desires to have these seasonal forecasts, and has ordered its Meteorological Department to furnish them. The Government encourages the work, provides the additional means required by the department for its proper performance, and issues the forecasts only to those who will use them as probabilities for practical guidance.

The Government of India have sanctioned large changes in its Meteorological Department in order to enable it to carry out the extensions of work that recent experience has shown to be desirable. The Department is kept in touch with scientific opinion and judgment at home through the Observatories Committee of the Royal Society. The relations to other scientific *departments* in India are maintained by a special committee termed the *Board of Scientific* Advice. The scientific staff has been largely increased.

The solar physics observatory at Kodaikanal and the magnetic observatory at Bombay have been placed under the Meteorological Department with a view to the complete co-ordination of the departments of scientific investigation for which they are maintained. Observational data for the whole Indo-oceanic area are now being collected and tabulated with a view to the early publication of daily and monthly weather reports and charts of that area.

The area to be dealt with (viz., the Indo-oceanic area) is partially covered by a number of independent meteorological systems, including those of Egypt, East, Central and South Africa, Ceylon, Mauritius, the Straits Settlements, and Australia. Large areas, as, for example Arabia, Persia, Afghanistan, Thibet, and the greater number of the islands of the Indian Ocean, are now almost completely unrepresented.

The departments controlling these systems work independently of each other, chiefly for local objects, and are in no way officially correlated or affiliated. Their methods of observation and of discussion and publication of meteorological data differ largely. It is hence difficult, if not almost impossible, to make satisfactory comparisons of the data, and trace out for the work of current meteorology the extension or field of similar variations, their relations to each other, and their probable influence on the future weather.

The work which should be carried out in order that the investigation of the meteorology of the Indo-oceanic area might be effective and as complete as possible includes the following :—

(1.) The extension of the field of observation by the establishment of observatories in unrepresented areas, and the systematic collection of marine meteorological data for the oceanic area.

(2.) The collection and tabulation of the data necessary to give an adequate view of the larger abnormal features of the meteorology of the whole area.

(3.) The direction by some authoritative body of the registration, collection, and tabulation of observations by similar methods in order to furnish strictly comparable data for discussion.

(4) The preparation of summaries of data required as preliminary to the work of discussion, and for the information of the officers controlling the work of observation in the contributory areas. The earliest publication of the data should be regarded as essential for the use of officers issuing seasonal forecasts.

(5) The scientific discussion of all the larger abnormal features in any considerable part of the area and their correlation to corresponding or compensatory variations in the remainder of the area, by a central office furnished with an adequate staff.

(6) Possibly, sufficient authority on the part of the central office to initiate special observations required for the elucidation of special features for which there are no arrangements in the general work of the various systems.

The Indian Meteorological Department is making preparations to carry out a portion of this work; and will undoubtedly do the best it can single-handed with its limited means. It cannot do the work fully and as it ought to be done. It can do nothing which requires authoritative control over the remaining meteorological systems in the Indo-oceanic field. It is collecting information from those who are willing to supply it, and will utilise it for its special purposes.

It is evident the work can only be carried out fully by the co-operation of the various systems subject to limited control by a central office with acknowledged imperial or general authority behind it. The most important part of the work from the standpoint of the science of meteorology is the comparison and discussion of the whole body of observations. The constitution, position, and authority of the central office is hence of the greatest importance. It is quite certain that none of the meteorological systems directly concerned can provide such a central office. If the work is to be carried out fully and systematically it can only be arranged for in England, and by the British Government assuming the general direction and control.

At the present time a section of the British Meteorological Office is devoted to the study of oceanic meteorology for the information of mariners. Another section should be created for the study of imperial meteorology for the benefit of its dependencies and colonies. I have reason to believe that the Government of India would contribute its share towards the cost of this extension of work.

In the preceding remarks are given the chief reasons for an important extension of work now in progress in the Indian Meteorological Department, an extension which can only be carried out imperfectly by that Department, but which could be performed with most valuable scientific results by the co-ordination of the labours of the weather bureaus concerned, with a central institution or investigating office in England under Government control.

Perhaps I may be permitted, from my Indian experience, to add some general remarks bearing on the methods and progress of meteorological inquiry.

In India the collection and publication of accurate current data relating to rainfall and temperature is required for the information of Government in its various Departments. The collection and examination of pressure and wind data by a central office with a view to the issue of storm and flood warnings is equally necessary. This work may, perhaps, be described as pertaining to descriptive or economic meteorology.

Economic meteorology, so long as it deals only with actual facts of observation, is not a science. Forecasts belong to the same department or branch of meteorology. They may be based on scientific theory and be obtained by scientific methods or the utilisation of empirical knowledge. The latter method is probably sufficient for by far the greater part of short-period forecast work, but the final development of that work and the preparation of long-period forecasts require the application of exact scientific methods and knowledge. And it is, perhaps, not too much to say that the extension of the range or period of forecasts is a measure of the progress of meteorology as a science. India, by the simplicity and massiveness of its meteorological changes (and perhaps Australia and Africa), appears to be best suited for the earliest experiments in this work.

India is, however, poor, not only in material wealth and capital as compared with England, but also in the appliances and means of scientific investigation, and hence looks to England for assistance and guidance in scientific matters. Unfortunately, England lags behind, not only the United States and Germany, but even behind India, in the important field of scientific meteorological inquiry. It will suffice to give a single illustration of the anomalous and inferior position which England takes in such matters.

All meteorologists and scientific men generally are agreed that the exploration of the middle and upper atmosphere by any available means—*e.g.*, kites, balloons, &c.—is of the utmost importance at the present stage of meteorological inquiry. The United States, France, and Germany have taken up the work vigorously. The British Meteorological Office is unable, for want of funds, to share or take any part in the work. The force of scientific and public opinion is apparently powerless to move the British Government to grant an extra five hundred pounds annually for this work. The British Government, on the other hand, some time ago suggested that the Indian Meteorological Department should assist. The Government of India, recognising the importance of the work, has provided the funds and sanctioned the arrangements necessary in order that its Meteorological Department may march with the most progressive nations in this investigation.

India has no body of voluntary observers or independent scientific workers and investigators. Whatever is required to be done to extend practical and theoretical meteorology can only be effected by the Government Department to which that work is assigned, with the sanction and at the cost of the Government—which naturally considers chiefly its practical wants in relation to its limited resources. It is, from one point of view, a painful if not quite an unexpected experience to me, on my retirement, to find that the Government of India is, in its attitude towards meteorological inquiry, more advanced, more liberal and far-sighted than the British Government, and that England has not yet taken up seriously the work of scientific meteorological investigation. There are undoubtedly too many observations and too little serious discussion of observations. The time has arrived when investigation should go hand in hand with accurate observation, and should direct and suggest the work of observation, and also that the sciences directly related to meteorology should be considered concurrently with it. There are undoubtedly definite relations between certain classes of solar phenomena and phenomena of terrestrial magnetism. The probability of definite relations between solar and terrestrial meteorological phenomena is also generally admitted.

Data for the determination of these relations are being rapidly accumulated, and numerous problems connected therewith are waiting and ripe for investigation. They are too large and complex to be undertaken by present English methods, and can only be attacked by a body of trained investigators under arrangements securing the continuity of method and thought requisite for the prolonged systematic inquiry gradually leading up to their complete solution.

It would hence be desirable to enlarge the scope of the central institution I have suggested, so as to include in its field of labour the investigation of the relation between solar and terrestrial meteorology and magnetism, so far as they can be solved by the comparison of the observations of the British Empire.

The central institution would thus have large and definite fields of work and most interesting problems for investigation. It would hence contribute towards the formation of a body of scientific meteorological investigators adequate to the importance and wants of the empire, and be of the highest educational as well as scientific value.

My predecessor in this position, Dr. Shaw, the head of the British Meteorological Office, made some remarks in his Address last year which deserve repetition in connection with this idea. He said:—"The British Empire stands to gain more by scientific knowledge, and to lose more by unscientific knowledge, of the matter than any other country. It should from its position be the most important agency for promoting the advance of meteorological science, in the first place because it possesses such admirable varying fields of observation, and in the second place because with due encouragement British intellect may achieve as fruitful results in this as in other fields of investigation."

The establishment of the central institution as suggested above would provide a remedy for the defects pointed out by Dr. Shaw. The reorganisation of the British Meteorological Office is, I believe, under consideration. Is it too much to hope that a strong expression of opinion on the part of the British Association, and the influence of the learned university at which its present meeting is held, would induce the British Government to spend an additional £5000 or £10,000 annually for the promotion of meteorological investigation and the establishment of a central imperial institution in London in connection with its Meteorological Office?

The Relation between Pressure, Temperature, and Air Circulation over the South Atlantic Ocean.

By Commander CAMPBELL HEPWORTH, C.B., R.N.R.

THE South Atlantic offers an excellent field for the study of air circulation on a comprehensive scale and under normal conditions. An ocean covering an extensive area, connected north and south with great oceans and completely open to the south, it is, at the same time, free from the disturbing influences of island groups, and is bounded east and west by continents having coastlines that are for the most part exempt from large irregularities of outlines. The atmospheric circulation over the South Atlantic may therefore be recorded as one vast wind system, its air-currents undisturbed over the northern half by the occurrence of aerial eddies for the most part, and over the southern half, although at times interrupted, yet not effaced by them.

The anticyclone, or area of high barometric pressure, is the great controlling agent of the system, and round this central high pressure the winds revolve.

The circulation of the air is assisted on the eastern side of the ocean by the relatively low pressure over South Africa, on the northern side by the low pressure over the equatorial regions of the Atlantic, on the western side by the relatively low pressure over South America, and on the southern by the lower pressure of higher latitudes. The direction of the wind about the core of high pressure, stated generally, is southerly to south-easterly between it and the African coast, south-easterly and easterly towards the equator, easterly to northerly on its western side, and north-westerly to south-westerly on its southern. Over the eastern and northern segments of the system the flow of the air-current is steady; over the western and southern, particularly over the former, the circulation is less persistent. *Southward* of 30° S. lat., and even further to the northward, on the western

side of the South Atlantic the apparent normal circulation of the surface wind, in harmony with the course of the average isobars, is largely masked by the incursion of low-pressure systems travelling eastward or south-eastward.

On the eastern margins of the South Atlantic and South Pacific north of 30° S. lat., and in a measure also on the western margin of the former, north of the same parallel, when the conditions of the atmosphere are stable, there appears a marked inclination for the wind to follow the course of the littoral. This probably is connected with the tendency of the barometric pressure over the land to conform to the contour of the coastline.

Throughout the twelve months the shape of the isobar bounding the area of highest pressure (30·1 or 30·2) is approximately that of an ellipse. The major axis, however, does not always make the same angle with the meridian, and the axes vary, not only in position, but also in length.

Over the South Pacific throughout the twelve months there is an area of high barometric pressure, the South Pacific anticyclone, which is elliptical in shape, and is bounded by an isobar of 30·2, except during the four months March to June inclusive, when the highest value shown is 30·1.

A table given furnishes particulars of the intensity, position, and extent of the high-pressure area over the South Atlantic and eastern margin of the South Pacific, and of the mean latitude of the belt of doldrums in the North Atlantic.

The area over which the south-east trade-wind blows steadily, and the region over which westerly winds predominate, vary from month to month in harmony with the change in the position of the South Atlantic anticyclone, and with that of its intensity and extent. These variations are pointed out.

There is a general relation to be found between the direction of the prevailing wind and the average temperature of the air in the shade over the South Atlantic, on either side of the permanent area of high pressure.

Throughout the year there is a marked tendency for the air-isotherms to extend along a line drawn from the Cape of Good Hope to the Island of Ascension under the influence of the relatively cool air of the south-east trades which blow on the African side of the high pressure, and in sympathy with the cool sea-surface current setting north-westward; while, at the same time, the relatively warm north-east wind on the American side of the anticyclone, which is in sympathy with the warm sea-surface current setting south-westward, exercises a similar influence upon the air-isotherms in the vicinity of South America.

Gale frequency on the South Atlantic is indicated in a table giving the latitude and longitude of the principal points in gale-frequency curves for different seasons.

Cyclonic storms of the South Atlantic appear to reach that ocean in two ways. They cross the continent of South America somewhere between 25° S. and Cape Horn, more frequently travelling over Patagonia; or they avoid the land altogether and round Cape Horn to the eastward, following the general drift of air and sea-surface.

The percentage curves seem to show that not infrequently the cyclonic system, instead of rounding Cape Horn or crossing the land, strikes northward or north-westward up the Pacific at a distance of 5° to 10° from the west coast of South America.

The Temperature of the Air in Cyclones and Anti-Cyclones, as shown by Kite-flights at Blue Hill Observatory, U.S.A.

By A. LAWRENCE ROTCH, B.S., M.A., Director of the Observatory.

A STUDY of the data obtained during 34 kite-flights at Blue Hill, at different seasons, and in areas of low and high barometric pressure, up to a height of about 12,000 feet, shows the mean decrease of temperature, computed by stages of 1,600 feet, to be nearly constant, averaging 1° Fahr. per 376 feet of ascent. Whether the whole column of air in a cyclone is warmer than the corresponding air in an anti-cyclone (as the convectional theory of its formation requires) depends chiefly upon whether its initial temperature at the ground is higher than that of the anti-cyclone, which is usually the case. If the data obtained from kite-flights on consecutive days be plotted for the same height (as was first done at Blue Hill in 1899), it is seen, that up to the height of 12,000 feet, it is generally warmer at all levels over areas of low barometric pressure than it is over the adjacent areas of high pressure.

Kite-flights on Blue Hill are usually made once a month upon a day fixed by the International Committee for Scientific Aeronautics. During 1903, the average of the highest points reached in the 15 flights was 7264 feet above sea-level, and the greatest height in any flight was 13,970 feet. From January to July, inclusive, this year, the nine flights have given an average elevation of 8284 feet, the highest one reaching 14,660 feet. During the present summer, it is hoped to extend the observations of temperature in the free air, by means of *ballons sondes* liberated from St. Louis, to an altitude never before obtained above the American continent.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE WETTEST SPOT IN THE UNITED KINGDOM.

REFERRING to Mr. Bonacina's interesting letter in last months Magazine on the above subject, and with a view to furthering the idea to find out the wettest spot in the United Kingdom, I beg to point out what appear to be conclusive facts, showing that if the surroundings and contour of the hills, above 3000 feet, in Kerry are as favourable as The Stye and Snowdon, the precipitat on at the wettest spot in Ireland ought to be higher than any place in England and Wales, for the following reasons :—

1.—As the direction of Kerry and Cumberland runs practically parallel with the general track of the Atlantic depressions, passing over the British Isles, the amount of precipitation due to the proximity to the mean path of the depressions, is as favourable at Kerry as at Cumberland and Carnarvonshire.

2.—Owing to Kerry being 300 and 200 miles more to the west and south than Cumberland, the rainfall would be likely to be more at

Kerry for the following reasons:—(*a.*) Higher average temperature. (*b.*) Surrounded by a larger expanse of the sea. (*c.*) More chances to obtain the precipitation, due to depressions passing northwards to the east of Kerry, and west of Cumberland, which, according to Dr. Mill's observation is heavier on the left side of the track.

3.—According to the general rule, places with a high yearly rainfall have a high number of rainy days. As the number of rainy days along the *sea coast* of Kerry is considerably more than the *sea coast* of Cumberland and Carnarvonshire, and assuming the mountain rainfall conditions are practically the same at Kerry as at The Stye, &c., the yearly precipitation on the Kerry hills ought to be more than at Cumberland, &c.

4.—The sea coast, or low level land rainfall,—viz., places *not* affected by any near hills—are probably the best guide or standard to ascertain the amount of yearly rainfall due to the geographical position and general track of the depressions, in regard to Kerry and Cumberland, &c, and the rainfall of these positions is well represented in the following places:—

Low-level and non-mountain standard for Kerry represented by	Valencia, Cahirciveen, and Darrynane Abbey, yearly average of—say 53 in.
Low-level and non-mountain standard for Cumberland—The Stye by	Maryport, Braystones, and Seascale of—say 36 in.
Low-level and non-mountain standard for Carnarvonshire—Snowdon by	Talarvor. Anglesey stations —say 36 in.

It will be seen from the map that the named sea coast places of Cumberland and Carnarvonshire are not affected by any mountain condensation from the *wet points*, but not having a contour map of Valencia and Darrynane in my possession. I cannot say whether Valencia would be partly affected by any low hills, but Darrynane appears unaffected. The wettest spot at Snowdon is situated 14 miles north-east of the sea coast standard station (viz., Talarvor), with an average rainfall of 190 inches, compared with 36 inches at Talarvor, therefore the combined high rainfall features, or points of Snowdon, give 5·3 times the sea coast standard.

The Stye is also situated practically 14 miles north-east of its sea coast standard (viz., Seascale), with about 175 inches, compared with 36 inches at Seascale,—giving the combined mountain rainfall features five times the standard. So we may take it roughly that the combined high rainfall points of the wettest places in England and Wales are five times the sea level standard.

Owing to the difficulty of finding any sea level standard rainfall along the west coast of Scotland, *not* affected on the weather side by the near hills, I have left Scotland out of the calculation, but I believe it is something like those of Cumberland and Carnarvonshire, and below Kerry. Taking the Kerry sea coast standard at 50 inches, and the combined high rainfall points of Brandon Hill (3127 ft.) and Carrantuohill (3414 ft.)—both practically the same

height as Snowdon and Scafell—at only four times the standard, it is evident that Ireland could claim a wetter spot than either England or Wales. So, in conclusion, I beg to ask,—is there not an Irishman living who would undertake to ascertain the *actual* amount at the wettest spot in Kerry?

J. R. GETHIN JONES.

Bod Gethin, Deganwy, Oct. 6th, 1904.

HEAVY RAIN ON AUGUST 30th, 1904.

LAST night we had a sharp thunderstorm accompanied by an exceptionally heavy downpour of rain, quite the heaviest I have ever observed either here or elsewhere. The rain began at about 7.45 p.m., accompanied by very vivid lightning, which latter, however, did not last very long. The rain continued till 11.15 p.m., when it ceased quite suddenly; the total fall in the three hours and a-half was 3·65 in. I should be glad to know if at other stations anything like this was observed.

J. ELDON ELLISON.

Timolin Vicarage, Ballytore, Co. Kildare, August 31st, 1904.

THE RAINFALL OF MANCHESTER.

WE have extracted the following information from some interesting notes on the rainfall, at Withington, Manchester, covering the period 1851—1903, for which we are indebted to Mr. J. H. Casartelli, of that city. The mean annual rainfall for the 53 years was found to be 33·15 in., and ranged between 51·23 in. in the wettest year (1872) to 21·26 in. in the driest (1887). The rainfall of the five complete decades included in the series exhibits striking differences, the range between the wettest and driest of such periods amounting to 6·60 in. The figures are—

1851-60.	1861-70.	1871-80.	1881-90.	1891-1900
in.	in.	in.	in.	in.
34·86	31·84	37·28	32·33	30·68

Although the length of the period necessary to admit of an accurate monthly distribution is open to discussion, we think that in the present case the observations have extended over a sufficient length of time to give values approaching the truth. The monthly means as calculated by Mr. Casartelli are :—

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2·67	2·07	2·23	1·79	2·14	2·90	3·20	3·46	3·21	3·65	2·80	3·05

The largest monthly total recorded during the period discussed was 7·15 in., in July, 1872, and the smallest ·09 in. in Febuary, 1858. The greatest fall in 24 hours ending 9 a.m. was 2·10 in. on July 13th, 1872,—a very moderate fall considering the length of the period over which the observations extend. The average number of rainy days was 183, the greatest number ever registed *being* 240 in 1872, and the least 131 in 1887.

THE ST. SWITHIN'S DAY TRADITION.

AMONG the weather sayings which have long been current, and have obtained a considerable amount of credit, is that which relates to St. Swithin's Day. St. Swithin was Bishop of Winchester in the ninth century, and died on 2nd July, 862. The tradition is that at his own request, he was buried in the churchyard of Winchester. But a century later, having been canonised by the Pope, the monks considered this an unfit place for the sepulchre of a saint, and resolved to transfer his remains to the Cathedral. The day fixed upon for this translation was the 15th July, 962. But the weather proved so unfavourable on that day, and for 40 days thereafter, through violent rains, that the transference was delayed for that period of time,—thence arose the saying that if it rained on St. Swithin's day, it would continue to rain for 40 days after. The following table showing the state of the weather in regard to rainfall on the 15th July for the last eighteen years, and the number of days on which rain fell in the 40 days succeeding, with the amount thereof, may serve to test the accuracy of the saying :—

Years.	Rainfall on St. Swithin's Day, 15th July. in.	Amount of rainfall for the 40 days following St. Swithin's Day. in.	No. of days on which rain fell in that period.
1887	·00	3·02	18
1888	·35	7·14	28
1889	·26	6·52	28
1890	·08	4·51	16
1891	·11	4·42	27
1892	·00	4·33	18
1893	·00	5·54	26
1894	·06	2·32	25
1895	·00	7·93	34
1896	·01	3·60	17
1897	·00	4·85	24
1898	·00	3·52	16
1899	·00	0·84	11
1900	·14	7·79	28
1901	·51	4·52	21
1902	·00	4·30	16
1903	·70	3·85	22
1904	1·40	3·98	25

From the above table it will be seen that from 1887 to 1904 there was no year in which rain fell for 40 days after the 15th. The greatest number was 34, in 1895 ; and in that year no rain fell on the 15th. There were three years in which rain fell on 28 days, and in all these the 15th was wet, and the total amount ranged from 6·52 in. to 7·79 in. On the other hand the next heaviest rainfall to these was 5·54 in. in 1893, with 26 days in which it fell,—and in that year the 15th was dry—and in 1897, in which the 15th was also dry there were 24 days, with 4·85 in. of rain, the next largest amount to those above specified.

WM. ANDSON.

Dumfries, 10th September, 1904.

RAINFALL AND TEMPERATURE, SEPTEMBER, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	1·17	— ·90	·18	30	11	74·9	5	39·1	26	0	2
II.	Tenterden ...	1·28	— 1·11	·30	6	13	72·5	5	38·0	26	0	0
,,	Hartley Wintney ...	1·23	— ·97	·32	14	8	72·0	5	33·0	30	0	4
III.	Hitchin ...	1·12	— 1·01	·28	30	13	71·0	5	33·0	19	0	...
,,	Winslow (Addington) ...	1·41	— ·85	·34	30	11	73·0	5	33·0	30	0	4
IV.	Bury St. Edmunds (Westley)	1·17	— 1·32	·32	30	12	72·8	5	34·5	30	0	...
,,	Brundall ...	1·78	— ·67	·50	6	11	72·0	5	38·0	26, 30	0	0
V.	Alderbury ...	2·00	— ·39	·76	12	10	69·0	3	34·0	26	0	...
,,	Winterborne Steepleton ...	3·13	...	1·08	30	12	69·1	28	32·5	20	0	8
,,	Torquay (Cary Green) ...	1·81	...	·82	11	11	67·7	3	44·1	27	0	0
,,	Polapit Tamar [Launceston]	2·52	— ·78	·56	13	13	67·3	29	32·9	27	0	0
,,	Bath ...	1·37	...	·41	12	7	69·5	5, 17	37·0	30	0	8
VI.	Stroud (Upfield) ...	2·27	— ·17	·52	30	13	71·0	5	42·0	20	0	...
,,	Church Stretton (Woolstaston)	2·12	— ·29	·72	12	12	66·0	5, 28	39·0	27	0	...
,,	Bromsgrove (Stoke Reformatory)	1·96	+ ·20	·55	12	9	68·0	18	35·0	29	0	...
VII.	Boston ...	3·13	+ 1·15	1·25	1	11	69·0	5	40·0	27	0	...
,,	Bawtry (Hesley Hall) ...	1·16	— ·73	·48	30	11	79·0	5	40·0	22	0	...
,,	Derby (Midland Railway)...	1·67	— ·34	·54	30	10	74·0	5	38·0	29	0	...
VIII.	Bolton (The Park) ...	1·73	— 2·43	·56	30	9	69·4	18	40·4	11	0	0
IX.	Wetherby (Ribston Hall) ...	·81	— 1·41	·30	2	11	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	1·75	— 3·43	·45	30	13	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	1·70	— ·53	·76	30	11	74·0	5	39·0	20, 28	0	0
X.	Newcastle (Town Moor) ...	1·18	— 1·00	·33	2	10	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	7·48	— 5·40	2·00	2	14	68·7	18	39·4	11	0	...
XI.	Cardiff (Ely) ...	4·03	+ ·28	·93	14	16	...	...	...	...	...	..
,,	Haverfordwest (High St.)..	5·10	+ 1·30	·89	7	16	67·0	17	34·4	27	0	1
,,	Aberystwith (Gogerddan)..	3·96	— ·11	·85	12	8	76·0	18	32·0	25	1	...
,,	Llandudno ...	1·15	— 1·72	·33	12	10	72·0	18	46·2	11	0	...
XII.	Cargen [Dumfries] ...	2·78	— ·97	·66	30	10	69·0	17*a*	35·0	27	0	...
XIII.	Edinburgh (Royal Observy.)	1·55	...	·55	25	10	68·4	17	41·6	21	0	1
XIV.	Colmonell ...	4·49	+ ·50	1·00	2	12	76·0	18*b*	36·0	26, 27	0	...
XV.	Tighnabruaich ...	7·26	...	1·31	5	15	60·0	1, 2*c*	38·0	10*d*	0	0
,,	Mull (Quinish) ...	4·61	— ·51	1·44	29	17	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	2·23	— ·68	·77	3	10	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	2·35	+ ·12	·90	2	14	69·6	7	38·5	14	0	...
XVII.	Braemar ...	2·14	— ·98	·71	2	16	65·0	19	29·5	14	3	14
,,	Aberdeen (Cranford) ...	2·33	— ·40	·89	2	15	65·0	2	34·0	13	0	...
,,	Cawdor (Budgate) ...	1·73	— 1·36	·50	2	13	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	7·92	— ·61	1·26	29	18	70·0	18	36·4	21	0	...
,,	Bendamph ...	8·19	— ·74	1·47	29	19	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	2·40	— ·19	·53	25	13	68·0	18	42·0	14	0	...
,,	Castletown ...	3·23	...	·77	13	22	66·0	6	32·0	22, 23	1	...
XX.	Killarney ...	3·42	— 1·26	·81	5	18	68·5	16	41·5	27	0	...
,,	Waterford (Brook Lodge)...	4·40	+ 1·27	1·00	7	15	65·0	17	35·0	27	0	...
,,	Broadford (Hurdlestown) ...	2·97	+ ·10	·54	7	18	66·0	18	38·0	21, 24	0	...
XXI.	Carlow (Browne's Hill) ...	3·35	+ ·62	1·10	12	14	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	2·34	+ ·22	1·20	12	17	71·6	5	41·1	29	0	0
XXII.	Ballinasloe ...	3·11	— ·03	·67	2	20	67·3	18	33·0	21	0	...
,,	Clifden (Kylemore House)..	5·97	— ·87	1·26	29	16	...	...	...	...	...	...
XXIII.	Seaforde ...	3·71	+ ·56	·92	2	11	68·0	7	39·0	10	0	0
,,	Londonderry (Creggan Res.)	2·68	— 1·19	·61	2	17	...	...	...	...	...	...
,,	/ *Omagh (Edenfel)* ...	3·00	— ·71	·70	2	16	67·0	18	35·0	10	0	0

+ *Shows that the fall was above the average*; — that it was below it. *a* and 18, 29. *b* and 19.
c and 6. *d* and 25, 26.

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·82	XI.	New Radnor, Ednol	2·49
,,	Sheppey, Leysdown	·93	,,	Rhayader, Nantgwillt	3·12
,,	Hailsham	1·69	,,	Lake Vyrnwy	2·57
,,	Crowborough	2·30	,,	Ruthin, Plâs Drâw	1·44
,,	Ryde, Beldornie Tower	1·93	,,	Criccieth, Talarvor	2·62
,,	Emsworth, Redlands	2·04	,,	Anglesey, Lligwy	2·37
,,	Alton, Ashdell	1·94	,,	Douglas, Woodville	3·74
,,	Newbury, Welford Park	1·51	XII.	Stoneykirk, Ardwell House	3·87
III.	Harrow Weald	1·50	,,	Dalry, Old Garroch	5·17
,,	Oxford, Magdalen College	1·44	,,	Langholm, Drove Road	2·92
,,	Banbury, Bloxham	2·05	,,	Moniaive, Maxwelton House	3·68
,,	Pitsford, Sedgebrook	1·98	,,	Lilliesleaf, Riddell	·96
,,	Huntingdon, Brampton	2·07	XIII.	N. Esk Reservoir [Penicuick]	2·00
,,	Wisbech, Bank House	1·99	XIV.	Maybole, Knockdon Farm	2·05
IV.	Southend	·98	,,	Glasgow, Queen's Park	3·12
,,	Colchester, Lexden	·84	XV.	Inveraray, Newtown	6·25
,,	Saffron Waldon, Newport	1·34	,,	Ballachulish, Ardsheal	8·82
,,	Rendlesham Hall	1·52	,,	Campbeltown, Redknowe	5·33
,,	Swaffham	2·24	,,	Islay, Eallabus	4·90
,,	Blakeney	1·86	XVI.	Dollar	3·57
V.	Bishop's Cannings	2·06	,,	Balquhidder, Stronvar	7·60
,,	Ashburton, Druid House	2·83	,,	Coupar Angus Station	2·32
,,	Okehampton, Oaklands	2·01	,,	Blair Atholl	3·44
,,	Hartland Abbey	3·37	,,	Montrose, Sunnyside	1·79
,,	Lynmouth, Rock House	2·32	XVII.	Alford, Lynturk Manse	2·16
,,	Probus, Lamellyn	2·39	,,	Keith, H.R.S.	2·58
,,	Wellington, The Avenue	1·56	XVIII.	Fearn, Lower Pitkerrie	2·34
,,	North Cadbury Rectory	2·27	,,	S. Uist, Askernish	...
VI.	Clifton, Pembroke Road	1·54	,,	Invergarry	5·72
,,	Moreton-in-Marsh, Longboro'	2·74	,,	Aviemore, Alvie Manse	2·43
,,	Ross, The Graig	2·16	,,	Loch Ness, Drumnadrochit	2·45
,,	Shifnal, Hatton Grange	2·31	XIX.	Invershin	2·24
,,	Wem Rectory	1·62	,,	Altnaharra	2·97
,,	Cheadle, The Heath House	1·97	,,	Bettyhill	2·49
,,	Coventry, Kingswood	1·89	,,	Watten, H.R.S.	2·79
VII.	Market Overton	1·91	XX.	Cork, Wellesley Terrace	3·88
,,	Market Rasen	2·27	,,	Darrynane Abbey	6·22
,,	Worksop, Hodsock Priory	1·21	,,	Glenam [Clonmel]	4·57
VIII.	Neston, Hinderton	2·09	,,	Ballingarry, Hazelfort	2·25
,,	Southport, Hesketh Park	2·24	,,	Miltown Malbay	4·52
,,	Chatburn, Middlewood	1·50	XXI.	Gorey, Courtown House	3·81
,,	Duddon Valley, Seathwaite Vic.	5·77	,,	Moynalty, Westland	3·49
IX.	Langsett Moor, Up. Midhope	1·49	,,	Athlone, Twyford	3·83
,,	Baldersby	1·26	,,	Mullingar, Belvedere	2·98
,,	Scalby, Silverdale	1·32	XXII.	Woodlawn	3·09
,,	Ingleby Greenhow	1·71	,,	Westport, Murrisk Abbey	4·40
,,	Middleton, Mickleton	·95	,,	Crossmolina, Enniscoe	3·81
X.	Beltingham	·63	,,	Collooney, Markree Obsy	2·91
,,	Bamburgh	·41	XXIII.	Enniskillen, Portora	3·12
,,	Keswick, The Bank	2·23	,,	Warrenpoint	3·65
,,	Melmerby Rectory	·96	,,	Banbridge, Milltown	3·21
XI.	Llanfrechfa Grange	2·54	,,	Belfast, Springfield	3·89
,,	Treherbert, Tyn-y-waun	5·41	,,	Bushmills, Dundarave	2·85
,,	Llandovery, Tonn	2·99	,,	Stewartstown	4·83
,,	Castle Malgwyn	3·10	,,	Killybegs	3·32
,,	Llandefaelog-fach	1·60	,,	Horn Head	3·88

METEOROLOGICAL NOTES ON SEPTEMBER, 1904.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

London, Camden Square.—Fine and dry on the whole. There were a few very gloomy and unpleasant days at intervals, especially in the first half, but a great many very fine ones; the weather during the week ending on 22nd being particularly brilliant. Duration of sunshine 133·3* hours, and of R 34·5 hours. Six sunless days. Mean temp. 56°·2, or 1°·5 below the average.

Tenterden.—The first half was rather unsettled, but the 4th, 5th, and 11th were splendid days. The third week was brilliant, with much E. wind. Duration of sunshine 191 hours.

Crowborough.—Cool and pleasant, with wind chiefly E. and N.E. Mean temp. 55°·0.

Hartley Wintney.—A perfect summer month, with little R and much sunshine, and absence of wind and of T. Cloudless from 18th to 23rd. Fog in mornings from 26th to 30th. Ozone on 16 days. Mean 3·6.

Pitsford.—Beautifully fine and bright. R ·62 in. below the average. Mean temp. 52°·0.

Brundall.—Fine on the whole, although there were some unsettled periods, particularly during the first half. Mean temp. 1°·2 below the average. The max. exceeded 70° on one day only.

Wellington.—Very fine and seasonable, with temp. equable, but rather lower than usual. R about ·75 in. below the average.

North Cadbury.—Showery and very humid till the 14th; very dry from 15th to 29th. High winds to 23rd, but very calm from 24th to 29th. No extreme temp.

Clifton.—Unsettled till 15th, when fine weather set in under the influence of an anti-cyclone, lasting, with the exception of a shower on 24th, till 29th, with cloudless skies for the first week, and afterwards, cloud. Sudden break on 30th with R and wind. R less than half the average.

Worksop.—A fine and pleasant month, and a grand time for fallowing work but roots would have benefitted with more R.

Bolton.—Singularly steady bar. caused by a series of high pressure systems. These gave rise to a fair amount of easterly wind and slight R. Absolute drought from 13th to 27th. Duration of sunshine well above the average.

Southport.—Mainly characterised by an unusual prevalence of easterly and south-easterly winds. Dry generally, the total R being 1·07 in. below the average. Mean temp. 0°·5 below the average. Duration of sunshine 22 hours above the average.

Hull.—Fine autumn weather generally, with some very bright days and mild nights. Duration of sunshine 126 hours.

Llandovery.—A very pleasant month. R very small, except on 2nd and 30th, on which days half the total occurred. Sunshine plentiful.

Haverfordwest.—Fine and warm. R above the average, mostly falling at night. Very fine from 17th to 24th, with no R but strong winds. Duration of sunshine 140·3 hours. Crops everywhere were excellent and harvested in good condition.

Douglas.—Very fine despite 3·74 in. of R, which all fell on nine days. From 17th to 28th was rainless and brilliantly fine, with drying winds, and the harvest was well saved. Strong N.W. gale on 9th, and a violent inshore (E.S.E.) gale on 12th, causing unusual dislocation of cross-channel traffic, and great difficulty in landing passengers here.

SCOTLAND.

Cargen [Dumfries].—Notwithstanding the wet weather at the beginning a better harvest had not been experienced for many years. Potatoes and turnips, however, suffered.

* Campbell-Stokes.

MAXWELTON HOUSE.—The last three weeks were very fine, bright and dry and excellent for the harvest.

LILLIESLEAF.—R 1·11 in. below the average. The latter half of the month was quite lovely, but the leaves were beginning to turn at the end. Crops were good and heavy and well got in, and there was no R to do any damage.

COLMONELL.—The first 9 days and the last 2 were wet, but the remainder was ideal weather for harvest, though there were slight falls on a few days and moderate to high winds.

TIGHNABRUAICH.—On 18th a slight earthquake shock was felt, preceded by a loud report at 4.10 a.m. No damage was done.

MULL, QUINISH.—Very warm and dry with E. wind from 10th to 25th. The harvest was unusually good.

CASTLETOWN.—Good harvesting weather throughout, most of the R falling during the night. Warm, damp winds from 18th to 24th.

IRELAND.

DARRYNANE ABBEY.—The first part was wet, followed by some very fine days from 18th to 26th. R 14 per cent. above the average.

MILTOWN MALBAY.—The first half was wet, the second dry and sunny and splendid for harvest.

DUBLIN.—A favourable month. R fell frequently up to 15th, very heavily on 12th but an anticyclone of much staying power and some intensity caused beautifully fine and bright weather from 16th to 25th. Mean temp. 56°·8. Duration of sunshine 161 hours.

MARKREE OBSERVATORY.—The first part was showery with no very heavy falls. Mild weather set in about 12th, and from that date very little R fell.

OMAGH.—The weather until the 16th was so persistently wet and unfavourable that fears for the harvest had become acute, when on the 17th a brilliant period of 12 days followed, and was taken advantage of so well that a harvest in this country has seldom been garnered in better order.

THE NINE MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—September, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	15·61	97	Arncliffe	41·77	98	Braemar	20·45	86
Tenterden	17·64	95	Hull	17·81	101	Aberdeen	20·89	95
Hartley Wintney	18·34	105	Newcastle	17·54	96	Cawdor	17·42	79
Hitchin	17·04	104	Seathwaite	93·24	102	Glencarron	62·63	97
Winslow	18·02	108	Cardiff	33·70	125	Dunrobin	21·09	100
Westley	16·25	90	Haverfordwest	32·06	112	Killarney	38·92	103
Brundall	15·75	88	Gogerddan	33·65	114	Waterford	33·47	123
Alderbury	21·95	118	Llandudno	19·84	98	Broadford	29·72	125
Ashburton	40·13	125	Dumfries	30·06	100	Carlow	26·78	113
Polapit Tamar	32·76	133	Lilliesleaf	22·75	107	Dublin	19·16	99
Stroud	22·54	118	Colmonell	31·61	105	Mullingar	27·18	103
Woolstaston	22·23	110	Glasgow	27·37	108	Ballinasloe	30·32	117
Boston	16·89	116	Inveraray	51·62	105	Clifden	62·49	112
Hesley Hall	17·06	115	Islay	36·95	119	Crossmolina	46·37	131
Derby	16·72	102	Mull	43·72	114	Seaforde	28·30	111
Bolton	24·83	84	Loch Leven	26·95	108	Londonderry	31·15	106
Wetherby	21·07	124	Dundee	21·60	113	Omagh	33·12	118

Climatological Table for the British Empire, April, 1904.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	67·9	14	35·8	22	59·0	42·4	42·4	77	112·3	27·4	1·02	10	5·6
Malta	74·6	12	45·2	1	68·9	55·6	53·1	77	124·5	43·7	·17	3	3·2
Lagos, W. Africa	90·0	25	70·0	20*a*	87·7	76·4	74·5	73	145·0	67·0	5·99	11	4·8
Cape Town	82·7	5	47·3	21	68·4	54·2	54·9	81	...	...	5·93	16	5·8
Durban, Natal	94·5	26	53·7	27	82·5	62·6	...	...	146·8	...	·65	5	2·7
Mauritius	84·4	5	62·3	13	80·4	68·4	67·2	79	149·1	55·2	4·00	21	6·4
Calcutta	101·5	23	69·4	10	95·2	77·4	74·6	72	157·3	67·0	·33	1	1·2
Bombay	91·1	28	75·2	18	89·0	77·9	73·5	74	140·6	68·8	·00	0	1·5
Madras	100·4	23	74·2	4	94·4	77·8	75·1	77	145·6	71·2	·00	0	2·1
Kodaikanal	77·3	6	48·8	15	70·4	54·0	49·7	64	140·8	37·3	4·21	11	4·0
Colombo, Ceylon	91·0	6, 7	73·6	19	88·9	77·8	74·3	78	153·4	68·6	5·40	13	5·5
Hongkong	83·8	26	59·7	1	75·2	67·8	66·6	86	139·0	...	1·91	12	8·3
Melbourne	86·9	14	41·8	18	71·3	50·9	51·9	73	140·1	34·2	·77	3	4·2
Adelaide	93·9	6	47·9	23	78·8	58·4	50·4	54	145·0	43·1	2·01	6	3·1
Coolgardie	97·5	5	42·9	18	79·8	55·7	48·3	49	160·3	36·8	·48	1	3·0
Sydney	77·0	3	53·3	21	69·6	59·2	57·9	86	116·3	41·9	12·60	28	6·2
Wellington	70·5	17	42·5	26	62·8	50·4	39·7	53	124·0	35·0	2·78	10	7·0
Auckland	71·5	4	48·0	28	65·7	54·9	52·1	74	134·0	40·0	5·33	12	5·0
Jamaica, Negril Point	89·3	12	66·9	1	85·1	70·1	69·5	73	...	...	5·82	9	...
Trinidad	90·0	17	65·0	scv.	83·9	67·6	73·0	84	159·0	60·0	2·50	9	...
Grenada	87·0	26	69·8	10*b*	82·7	73·6	68·6	73	146·2	...	3·35	17	3·9
Toronto	58·3	9	19·2	20	47·0	31·4	32·1	76	122·7	11·0	3·11	14	6·5
Fredericton	64·7	24	6·7	4	50·9	27·6	23·7	50	...	...	4·19	11	5·9
Winnipeg	...	...	...	...	...	...	...	...	...	...	...	...	...
Victoria, B.C.	73·6	12	35·2	7	57·4	44·0	...	...	...	...	·75	7	6·1
Dawson	57·5	24	0·0	3	45·5	23·1	...	...	...	...	·57	7	5·3

a and 28. *b* and 11

MALTA.—Mean temp. of air 60°·7 or 1°·1 above the average. Mean hourly velocity of wind 0·1 miles below average. Mean temp. of sea 63°·0.

Natal.—R 2·24 in. below 30 years average. Hot winds on 25th and 26th.

Mauritius.—Mean temp. of air 1°·2, dew point 1°·6, and R 1·20 in. below, averages. Mean hourly velocity of wind 8·8 miles, or 1·7 below average.

KODAIKANAL.—Mean temp. of air 60°·2. Bright sunshine 222 hours, daily wind velocity 287 miles.

COLOMBO.—Mean temp. of air 83°·1, or 0°·6 above, dew point 0°·3 below, and R 5·79 in. below, averages. Mean hourly velocity of wind 8 miles.

HONGKONG.—Mean temp. of air 70°·7. Bright sunshine 112·4 hours. Mean hourly velocity of wind 14·8 miles.

Adelaide.—Mean temp. of air 4°·6 above normal, and only once exceeded in 48 years. R ·18 in. above average.

Sydney.—Mean temp. of air 1°·6 below, humidity 7·7 above, and R 6·97 in. above, averages.

Wellington.—Mean temp. of air 4°·6 above, and R 1·73 in. below, averages.

TRINIDAD.—R ·38 in. above 40 years average.

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THE VENGEANCE OF THE RAIN GODS.

By the Editor.

Among the latest of the ever-fresh and interesting notes "From an Oxford Note Book," in *The Observatory*, we find a racy sketch of a railway journey in the south-west of the United States, describing how a train dodged the "wash-outs" of August last, on its way to and from the Grand Canyon of Arizona. The travelling astronomer does not venture to assign any occult reason for the cause of his troubles, though a superstitious soul might easily see that the stars in their courses fought against him.

We happened to follow the same route a month later, also paying a visit to the Grand Canyon, a natural feature vaster and more impressive than Niagara itself, and less easy to describe, for Niagara differs only in magnitude from humbler cataracts known to everyone, but the Grand Canyon is altogether unique, and comparison with nothing familiar can help one to realize it. We, too, met with "wash-outs," but putting ourselves in the position of the original dwellers on those arid plains we met also with extremely instructive reasons for their occurrence; reasons which suggest some reflections.

Escaping from the chaos of St. Louis and the noise and heat of the World's Fair in a special train of Pullman cars, a party of about sixty members of the Eighth International Geographical Congress crossed the Mississippi and sped over the rich farming lands of Kansas for a night and a day. That State, larger than England and (this year) as green and fertile, grows gradually drier towards the west, where the diminishing rainfall begins to be supplemented by irrigation. When it is followed by Colorado, New Mexico and Arizona, the aridity increases, until the land no longer bears crops, no longer supports live stock, and finally becomes a nearly waterless desert, the brown surface only starred by patches of cactus-like vegetation with here and there a grove of small pines, which seem to find sufficient moisture in the dew. When we passed, there had been no rain for a month or more, and insufficient rain for several years. The mean annual fall is well under ten inches, and on the edge of the

as was then roaring from the water-pipes of the roof and making the shelter of the broad cloisters round the hotel welcome for another reason than its shade. We breakfasted leisurely because the train we waited for was late, and gloomily because the sleeping cars were all full and we should have to travel in the day car and sleep at Trinidad, Colorado, losing a day and running some risk of missing the steamer at New York. However, when the train came up room was found in the Pullman and we proceeded on our way accompanied by rain as persistent as ever graced Seathwaite or the West Highlands. Rivers which four days earlier had looked like wide and badly-metalled roads were now rushing brown torrents overflowing their banks. The train ventured cautiously along the embankments which the streams were rapidly washing away. At every bridge a group of anxious men stood watching the rising water and we awaited their signal before commencing to creep across. At one point, in passing through a cutting at the base of a sudden volcanic hill, a piece of stone loosened by the wet bounded down the slope and through the last window of the train, dashing the thick plate glass into fragments. A second later it would have gone clear, a second earlier it would have burst like a shell into one of the sleeping berths. We reached Trinidad at midnight, with many stops and jerks, and the cry from an awakened sleeper, "Off the rails at last; I guess we're hung up for three days"; but we jolted on, and at noon next day, when passing in fine weather through fertile Kansas, we learned from the newspapers that three hours after we had left it Trinidad had fallen a victim to the flood. Five hundred feet of the railway had been washed away, the gas and electric works flooded and all lights extinguished, the railway station wrecked, and immense damage done in the town. The train behind had to wait two days, but we reached New York up to time.

Weeks afterwards we heard of the special train which we left bearing the unwilling rain gods towards Mexico. It had not proceeded far on its way to the frontier when a "wash-out" on the line and a broken bridge ahead compelled it to stop, and an attempt was made to return to Albuquerque only to find that another "wash-out" had occurred later, imprisoning it for three dreary and hungry days. There was no dining car on the train, but forty dozen eggs were commandeered from the freight car of a train behind which was caught in the same misfortune. A solitary hut supplied the typical Mexican cakes known as tortillas, to the great profit of the lady in charge but little to the satisfaction of the party. A steak was procured somehow and cooked on the coal shovel over the engine fire, and those passengers were happy who secured a square inch of the tempting delicacy.

So much for the story; the moral is shorter. The Pueblo Indians, when next their priest tries to reason with them in the little church on the futility of their superstitious dances, will think complacently of the unmistakable efficacy of the rain dance of September 25th,

which had produced the memorable rains of the 28th and 29th, and all other arguments will be of no avail. The Navajos, if ever they hear of the fate of the excursion train, will have no hesitation in tracing the rain gods' vengeance for the desecration of their shrine, and they will set up new images with increased confidence in their power to control the elements. They will argue, not without reason, but the reason they give is not scientific and purely fallacious. The Indians will not remember instances of rain dances held in vain, of rain gods stolen or destroyed without a break in the serenity of the sky, nor will they consider the hard fate of the train with the eggs, which was carrying a crowd of innocent visitors returning from St. Louis to their homes without the luxury of sleeping cars.

The Navajo, who attributes the rain to divine vengeance, will never listen patiently to the Pueblo who knows that it was a reward for a particularly meritorious ceremony; nor will the Pueblo tolerate the belief of the Navajo any more than the moon-weather-man, who proves that the waxing moon brings rainy weather and the waning moon brings dry weather, will admit the accuracy of his brother-crank, who demonstrates the drought of the waxing and the drench of the waning phases of that unconscious orb,

We can afford to smile at the Navajos and the Pueblos, and at other illiterate persons, who look on the weather and on life with unscientific eyes. But we must not smile upon any attempts to claim scientific value for unrelated coincidences, however well meaning they may be, or however conscientiously the persons putting them forward may believe in their unproved hypotheses. It is true that the detection of coincidences not infrequently leads to the discovery of a law connecting phenomena, but to the scientific mind the exceptions must be explained before the rule can be proved, and a theory which may be true cannot be assumed or announced as true until it has been rigidly tested. We have convinced ourselves that the Navajo and Pueblo type of mind, in civilized man at least, is incapable of realizing its own limitations, and will persist in its own modes of thought, despite all arguments, and we shall try no more to influence it: but we feel it a duty to urge our readers to beware of forming conclusions, even in meteorology, without full information.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE ST. SWITHIN'S DAY TRADITION.

I THINK that one may take it for granted that in all popular traditions and superstitions there is a substratum of truth. It is "unlucky" to pass under a ladder, because there may be a man painting atop. It is "unlucky" in driving to divide a flock of sheep, for just as you are passing, those on one side may run under your wheels to rejoin those on the other side. It is "unlucky" to spill the salt at table, because this shows that your hand is not in the state of steadiness which indicates normal health.

Now the legend of St. Swithin is that if it rains on July 15th it will rain for the 40 days following, and *vice versâ*; *i.e.*, that at that particular period of the year the weather is likely to remain fixed, in one direction or another. It occurred to me some years ago to verify this by dividing the whole year into periods of 40 days, and seeing whether there was a less difference between the daily maximum and minimum rainfall during the period succeeding July 15th than during any other such period. By the courtesy of the Secretary of the Royal Meteorological Society I obtained access to the returns for the previous 20 years, which I carefully tabulated. I have, unfortunately, mislaid my MS., and cannot now put my hand upon it. But I remember that the outcome of my enquiry was that there were two 40-day periods when the weather appeared to be much more constant than in any other such period, and that of these two the St. Swithin period stood clearly first.

W. C. PLENDERLEATH.

Mamhead Rectory, Devon,

We take the liberty of quoting the following interesting letter from *The Observatory*:—

A letter from a Dumfries correspondent in the October number of *Symons's Meteorological Magazine* has suggested an inquiry as to the verdict of the Greenwich records on this subject. I have examined the figures for 64 years (1841 to 1904), counting only the days when 0·005 inch was registered, and it certainly seems that the tradition does not find very strong support.

In some few years (*e.g.*, 1856—1863, when the rain gauges were only examined at 9 p.m.) there is a little doubt as to the day on which rain actually fell, but it is of no great consequence.

In no year were there more than thirty-one or less than four wet days in the forty succeeding July 15, so that the probability of absolute accuracy of the tradition vanishes at once.

In twenty of the years at least half of the forty days were wet, but in only five of these years was St. Swithin's Day wet, and it was dry in the two years showing most wet days in the forty. On the other hand, although in the two driest seasons, with only four and six wet days respectively, in

the period under consideration, St. Swithin's Day was dry, yet in 1887, after a wet July 15, only nine of the forty days were wet.

From another point of view, the heaviest rainfall during the forty days, which was 9·73 inches in 1903, followed a dry St. Swithin's; and of the sixteen years in which that period produced over 4 inches of rain, only two had a wet St. Swithin's.

It would seem, therefore, that the legend does not apply to Dumfries or Greenwich. Perhaps Winchester records might tell a different tale, but it is not likely, even if they allowed for the change of style, which would alter the date by a week.

It is noticeable that there has been no rain at Greenwich on July 15 since 1896, and in the whole period there are 41 dry festivals as against 23 wet ones.

On an average, a wet St. Swithin's entails 17 wet days out of the next 40, with an average total rainfall of 3·13 inches, and a dry one brings the same number of wet days with an average total rainfall of 3·33 inches.

W. W. B.

BALL LIGHTNING.

I HAVE been informed of the two following different cases of ball lightning:—Some years ago, probably in 1887, the station master at Cranleigh was walking along the platform during a heavy thunderstorm with rain; just as he was about to pass under the roofing a fire ball fell on the platform at his feet, bursting with a great flame, but doing no damage. It occurred just in front of the window of his own house, and his wife, who was looking out of the window at the time, saw the fire ball fall and explode, and was greatly alarmed until she saw her husband was safe. The ball was described as being larger than a cricket ball.

In 1891 a fire ball fell in Ampthill-road, Bedford, during a thunderstorm. Captain Tottenham, who saw it fall, told me that the ball came down like a red hot shot, and made a hole into which he thrust his stick the next morning.

J. P. MACLEAR.

Chiddingfold, 17th October, 1904.

THE DRY AUTUMN OF 1904.

I HEREWITH submit the following remarkable figures of rainfall, September and October, 1903 and 1904:—

		Depth. Inches.	Number of rainy days.
1904.	September	0·60	5
,,	October	0·74	8
		1·34 inches in 2 months.	

Total rain from 23rd August—that is 68 days = only 1·41.

Compare this with last year:—

		Depth. Inches.	Number of rainy days.
1903.	September	2·62	17
,,	October	8·07	26
		10·69 inches in 2 months.	

A few miles away in September there fell one or two showers which did not touch me here.

Surely taking September and October together the smallness is a record.

W. F. VINT.

The Cedars, Sunderland, October 31st, 1904.

It will interest you to know that last month's record of the rainfall at Lockwood Reservoir—on the moorland between Whitby and Guisborough—shows that rain fell on 10 days, but the total fall is only 0.57 in.

This is the lightest rainfall for any month of October since our gauge was fixed in the spring of 1872.

WILLIAM I'ANSON.

Saltburn-by-the Sea, 4th November, 1904.

The following may be reprinted in connection with the above:—

A CONTRAST IN LONDON RAINFALL.

To the Editor of The Times.

Sir,—This day last year I addressed to you a letter recording the fact that the rainfall at this station since January 1 had reached the total of 34·61 in., thus exceeding the total fall of any whole year since the record began in 1858. It may interest some of your readers to know that the rainfall here for the present year since January 1 amounts only to 17·09 in., rather less than half of the fall in the corresponding period of the unprecedentedly wet year 1903. The contrast is striking and cannot fail to attract the attention of all those whose interest in the weather prompts them to keep a rain gauge.

The mean rainfall for the first ten months of the 45 years 1858—1902 is 20·59 in. at this station, thus 1904 has so far had 83 per cent. of the average, while last year to the same date had 168 per cent. Eleven years in the last 46 have been drier for the same period than 1904 has proved, the extreme case for the ten months having been 1898 with 13·21 in., while 1864 and 1887 had also less than 15 in. for the same period,

Unless November and December prove quite exceptionally wet, this year will once more confirm the apparently meaningless "rule" that all years ending in four are dry; since 1814 there has only been the one exception of 1894.

Your obedient servant,

HUGH ROBERT MILL.

62, Camden Square, London, N.W., Oct. 28.

STRUCTURAL DAMAGE BY LIGHTNING.

We are indebted to Mr. F. Rayner, C.E., of Nottingham, for calling attention to the interesting case of damage by lightning, illustrated in the accompanying photograph, for permission to reproduce which we have to thank Mr. Morris, of Bingham.

During a severe thunderstorm on March 29th, 1904, the house shown in the photograph was struck by lightning and wrecked. From the picture it appears that the discharge took place along the chimney, which was split open down to the ground, while almost the whole wall of the upper room was thrown down and the roof above it collapsed. No one was killed, though one person was slightly injured. The house stood in the village of Whatton, in the Vale of Belvoir, about half-a-mile from Aslockton Station on the Great Northern Railway.

Photograph by Mr. Morris, Bingham, Notts.]

EFFECT OF LIGHTNING AT WHATTON.

METEOROLOGICAL NEWS AND NOTES.

HIS MAJESTY THE KING has intimated that it will afford him much pleasure to become an annual subscriber to the funds of the British Rainfall Organization, in the work of which he has already been graciously pleased to participate by supplying records of the fall of rain from Buckingham Palace, Windsor, Sandringham and Balmoral. The conspicuous honour done to this voluntary organization by the King must be profoundly gratifying to all observers.

THE PRINCE OF WALES has honoured the Royal Meteorological Society by accepting the position of Honorary President. This new office, inaugurated under such distinguished auspices, cannot fail to increase the dignity and usefulness of the Society.

THE ASTRONOMER ROYAL, who, in addition to his astronomical duties, is charged with the oversight of what may be called the official meteorological station for London at Greenwich Observatory, has been created a Knight Commander of the Bath, a well-deserved honour, on which we heartily congratulate Sir William Christie.

THE METROPOLITAN BOROUGHS of Holborn and Stepney have followed the excellent example of the City of London, Chelsea and Hackney, in establishing official rain gauges which fill wide gaps in the rainfall system of London. It would not be too much if there was one rain gauge to every square mile of the metropolitan area, where the determination of the exact distribution of heavy rains is often a question of great practical importance, and the examples cited above might well be followed by the other municipalities which are still without observations.

THE ANTARCTIC EXPEDITIONS, under the leadership of Captain R. F. Scott, R.N., C.V.O., on the *Discovery*, and of Mr. W. S. Bruce, on the *Scotia* have returned to this country and the observations and collections are now being worked up. The Royal Society has appointed a committee to co-operate with the Meteorological Council in the reduction and discussion of the meteorological observations of the National Antarctic Expedition.

THE BEN NEVIS OBSERVATORIES ceased work on October 1st, a circumstance which we regard as nothing less than a national calamity. We have in type the report of last year's work at the Observatories, which we hope to publish next month, and we may then have something to say on the unfortunate state of matters which made such a catastrophe possible.

THE SECOND METEOROLOGICAL VOLUME of the International Catalogue of Scientific Literature has just been published. It is a distinct advance on the first volume, but not yet by any means a satisfactory record of the science.

METEOROLOGY AT THE BRITISH ASSOCIATION.

(CONTINUED).

Suggested Uniformity of Units for Meteorological Observations and Measurements.

The following suggestions adopted by a Committee of the Council of the British Association, were presented by DR. W. N. SHAW.

IT should be premised that international uniformity can be regarded as *urgently* desirable only as regards the units adopted for the publication of results, the preparation of weather maps, &c. This purpose can be attained without requiring uniformity as regards the graduation of instruments used by observers. A change of system for the purpose of publication does not therefore necessarily involve an immediate or general change in the instruments now in use. But as the natural tendency would be to adapt the instruments to give readings in the units used for publication, the question is treated in this memorandum upon that understanding.

Uniformity has been obtained for electrical measurements by the adoption of the C.G.S. system, and due weight should be given to the advantage likely to arise from extending a system which has already proved itself successful.

1. Units of temperature and length are required for meteorological measurements of air temperature and humidity, pressure, rainfall, and wind velocity.

2. Units based on the inch or its multiples and the Fahrenheit degree are employed in the official organisations of the United Kingdom (including British ships of all kinds), India, Australian Commonwealth, South African Colonies, the Crown Colonies and dependencies, including, East, Central, and West Africa, the West Indies and Canada, and in the United States.

Units based on the metre and the Centigrade degree are employed in the official organisations of the Continent of Europe, including Asiatic Russia and the Colonies of France, Germany, Portugal, Holland and Belgium, and the Congo State, Egypt and the Sudan, Argentine, Brazil, Mexico and Japan.

The results for the Philippines are issued in both systems.

3. It may be added that British and American writers in scientific publications occasionally use Centigrade and Metric units, but the converse does not occur.

4. In meteorology the measurements of length are for the most part indirect, and although the substitution of millimetres for inches of rainfall, or of metres per second for miles per hour of wind velocity, might be held to turn upon the general adoption of a metric system, yet it is not unreasonable to consider the meteorological units separately from those of a general system.

5. The distribution of instruments in use on either system is so wide that any change could only be recommended upon reasons which appeal to scientific men in general, and especially to those engaged in the practical applications of science.

6. The choice of units may be approached from two points of view—viz., that of the observer and that of the computer or tabulator.

7. From the point of view of the observer that unit is the best which

employs the fewest figures to represent the reading of the instrument to a practical degree of accuracy; which permits the greatest simplicity of graduation; and which makes the process of reading as nearly as possible identical for every position on the scale.

8. From the point of view of the tabulator and computer, that unit is the best which employs the fewest figures, and which makes the process of computation independent of the position of particular readings on the scale.

9. The most appropriate way of arriving at a selection of a suitable unit is, therefore, to consider—(1) The degree of accuracy practically attainable. (2) The appropriate position for the zero of practical measurement. (3) The number of figures required to represent all the values within the practical range. (4) The mode of graduation of the scale or vernier required for reading.

10. *Air Temperature—Degree of accuracy.*—The limit of practical accuracy of a thermometric reading with a mercury in glass thermometer, making appropriate corrections for change of zero, is fairly represented by 0°·1 C. (0°·2 F.). On account of the effect of different methods of exposure and other accidental circumstances, meteorology cannot effectively take account of differences of individual readings of less than 1° F., or 0°·5 C., as regards air temperature; though as regards the application of temperature readings to the measurement of humidity an accuracy of 0°·1 C. (0°·2 F.) is required.

Position of Zero.—The zero should be so chosen that all observed or recorded values are positive. Negative values should be regarded as inadmissible; they introduce very serious danger of error both for the observer and computer. The observer has to adopt a different mode of estimating fractions of a scale division in different parts of the scale, and the computer has to change his mode of operation and to use a + and — notation, which is a serious complication.

Number of Figures.—The Fahrenheit range 0° F. to 100° F. covers nearly all temperature readings in temperate climates, but to include all atmospheric temperatures a range of about 230° F., from —100° F. to + 130° F. would be required; say, 130° C. from —75° C. to + 55° C. Expressing these on scales measured from absolute zero, a comprehensive range in Fahr. degrees would be from 360° to 590°, or in Centigrade degrees from 200° to 330°. With the Centigrade degree, four figures on the absolute scale would give a reading to the practical limit of accuracy; the first figure could almost always be assumed known. In Fahrenheit degrees four figures would go beyond the practical limit of accuracy; the omission of the first figure would be less safe. The freezing point of water would be [2]73° in the one scale, [4]91° in the other.

Mode of Graduation.—For the observer divisions of a scale should correspond to digits in the value expressed. Graduation into fifths is liable to cause errors. Estimation should be to a tenth of a division of whatever scale is adopted.

It may be noted that the Fahrenheit degree corresponds almost exactly with the expansion of mercury by the ten-thousandth part, while the Centigrade degree corresponds very nearly with the communication of the heat equivalent of a Joule (10^7 ergs) to a gramme of dry atmospheric air.

11. *Humidity*—This is generally determined from readings of the temperature of the dry and wet bulbs. If any considerable degree of accuracy is

aimed at, the difference of temperature of the two bulbs should be correct to 0°·1 C. It is, however, only the difference that is required to be known with that accuracy. The measurements as at present carried out in practice are not in any case altogether satisfactory, for reasons which need not be specified here. The International Committee were unable to include tables for the reduction of readings of the dry and wet bulb in their volume of Meteorological tables.

12. *Pressure.—Degree of Accuracy.*—The practical accuracy of the mercury barometer with skilful setting and reading is ·002 inch to ·003 inch (·05 to ·08 mm.). For most purposes in temperate latitudes an accuracy of ·1 mm. (·004 inch) would be sufficient. Telegraphic reports in this country give the nearest hundredth of an inch (·25 mm.), but in tropical countries the third decimal place is reported (·025 mm).

Position of Zero.—The barometer is always graduated from zero pressure, so that negative values never arise.

Number of Figures.—The range at sea level slightly exceeds that between 28 and 31 inches (710 mm. to 790 mm.). The millimetre scale, with the omission of the first figure, complies fairly well with the conditions indicated if a high degree of accuracy is not required.

Mode of Graduation.—In this respect neither system is very appropriate. The usual mode of graduation of the inch barometer is very unsatisfactory; the scale is divided to 20ths of an inch, and the vernier carries the division to the 500th. The observer is expected to add 5 to the figures marked on the vernier, if he is dealing with the higher half of a 10th, and each of his final divisions counts two-thousandths. Errors in barometer readings on these accounts are not infrequent. The system has passed from the laboratory into general practice without sufficient consideration for the fallibility of the observer. On the other hand, a millimetre scale is too crowded for easy reading, and mistakes of a millimetre are occasionally made. Again, a vernier to read to ·1 mm. is too short, and one to read to ·01 mm. is too long. An accuracy equal to that of a thousandth of an inch is obtained with a 40 mm. vernier, but this would give readings in divisions of ·025 mm.

With the decimal notation it is evidently impossible to select a scale and vernier to which no objection can be urged, because, whatever length of division is chosen, verniers used to give 10ths and single 100ths would be too short and too long respectively. Unless some other method than that of the vernier be used, a sub-division of the main scale or of the vernier scale into halves or fifths must be accepted for measurements of the highest accuracy, but it is not necessary for the accuracy of a great number of practical measurements.

If the convenience of the observer alone were taken into account, a scale division somewhat greater than the twentieth of an inch, which is itself a little larger than the millimetre, would give a scale very easy to read. There is no scale in practical use in which this interval corresponds to the successive digits of any decimal place. It is, however, a matter of some interest that the interval corresponds very nearly with 2,000 absolute units of pressure on the C.G.S. system.

Barometric corrections are concerned with temperature, height above sea-level, and latitude. It is in many ways desirable for a reader to be able to

know from the figures themselves whether barometric readings have been corrected for latitude or not. The latitude correction is a small one, and the figures at present give no indication upon the point; but the distinction might easily be made clear if it were understood that pressure data corrected for latitude should be expressed in absolute C.G.S. units. Then if the subject were being approached *de novo* it would be reasonable to suggest the use of what might be called an observer's "degree of pressure,"—viz., a scale of lengths with each division corresponding to 1·5 mm., or about ·06 inch (*i.e.*, to 2,000 C.G.S. absolute units in latitude 45°).

Upon such a scale of "degrees of pressure," a $\frac{1}{10}$th vernier, or preferably a $\frac{1}{20}$th vernier, with alternate divisions omitted, would carry the accuracy of reading to ·006 inch, and would define quite satisfactorily the degree of accuracy required in setting and reading for such practical purposes as telegraphic reporting in temperate climates, while a $\frac{1}{50}$th vernier would reach the extreme practical limit of accuracy of the mercury barometer under meteorological conditions.

This would give as nearly as can be secured an ideal scale for observing. Reduction to absolute measure would be obtained by the application of the gravity correction and the simple process of multiplication by two.

It is hardly necessary to say that if temperature were directly referred to the absolute zero which is practically the zero of the gas thermometer, and pressure were expressed in absolute C.G.S. units, many of the calculations of the thermal and dynamical properties of gases would be immensely simplified. No confusion would be likely to arise between the observer's "degree of pressure" and the corresponding absolute units because the limited range of readings of pressure at sea-level would be sufficient guide.

The proposals indicated would not affect the mode of procedure in determining the fixed points of a thermometer, which would still be the melting point of ice under certain defined conditions, and the boiling point of water under the pressure of a standard atmosphere, but the melting point would be marked [2]73°, the boiling point [3]73°, and the standard atmosphere would be 506·33 "degrees of pressure," latitude of London, or $1{\cdot}01325 \times 10^6$ dynes per sq. cm., which might perhaps be called 1013·25 "kilobars."

13. *Rainfall.*—In this country readings are carried to hundredths, sometimes to thousandths of an inch, but the readings to the higher degree of accuracy have seldom any practical meaning. The range is from ·01 to 3, 4, or even more inches in exceptional cases for a day's rain; the large majority of readings are certainly under 2 inches. In metric units 10 cm. would cover all but very exceptional falls, and ·1 mm. would represent satisfactorily the highest degree of accuracy.

14. *Wind Velocity.*—The degree of effective accuracy of wind measurement depends much more upon the exposure than on the graduation of the instrument. The mile per hour is a good unit of wind velocity, because a real velocity of one hundred miles is hardly ever, if ever, exceeded, and thus two figures are sufficient, while an accuracy defined by one mile per hour is as much as can be expected to express any velocity. The corresponding range in metres per second extends to forty-five metres per second, and as measurements can be easily made to one mile per hour, less than half a metre per second, three figures would be necessary to express wind velocity in metric units.

THE TEN MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—October, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	17·17	92	Arncliffe	44·69	91	Braemar	21·74	78
Tenterden	19·62	91	Hull	18·31	89	Aberdeen	21·92	87
Hartley Wintney	20·07	98	Newcastle.....	18·35	87	Cawdor	18·75	75
Hitchin	18·17	96	Seathwaite ...	102·43	97	Glencarron ...	69·70	95
Winslow	18·98	98	Cardiff	36·39	116	Dunrobin	22·91	94
Westley.....	17·39	84	Haverfordwest	34·31	102	Killarney ...	...	...
Brundall.....	16·95	83	Gogerddan ...	36·88	105	Waterford ...	35·21	113
Alderbury	23·67	108	Llandudno ...	21·13	87	Broadford.....	32·87	123
Ashburton	42·95	113	Dumfries	32·34	93	Carlow	28·29	104
Polapit Tamar ...	35·08	120	Lilliesleaf	23·71	97	Dublin	19·61	88
Stroud	23·12	106	Colmonell	34·20	100	Mullingar.....	29·68	101
Woolstaston	22·93	97	Glasgow	29·10	102	Ballinasloe ...	33·09	112
Boston	17·80	106	Inverary	57·31	102	Clifden	67·41	106
Hesley Hall	17·38	100	Islay	41·40	115	Crossmolina ...	49·35	121
Derby.....	17·27	91	Mull	49·02	111	Seaforde	29·15	100
Bolton	27·73	81	Loch Leven ...	28·80	101	Londonderry..	33·95	102
Wetherby	21·79	110	Dundee	22·30	102	Omagh	36·63	114

The month of October proved dry generally, and as the correspondence published on another page shows, it was very dry in several localities. With the exception of the South-west of England, South Wales, and the West of Scotland, considerably less than the average rainfall occurred over Great Britain in the first ten months of 1904. The average used in the above Table is that of ten years which were exceptionally dry in most parts of the country, so that the year as far as it had gone promised to be one of unusually low rainfall. The areas where rainfall was most deficient were in the East and North-west of England, and in the North-east of Scotland, and some difficulties as to water supply occurred in these districts, and especially in Manchester. In Ireland the rainfall exceeded the average, except in the immediate vicinity of Dublin. The unprecedentedly wet October of 1903 led to an average excess of 45 per cent. of rainfall for the ten months; the exceptionally dry October this year leads to a deficiency of about 1 per cent. for the ten months, in each case considering the whole area of the British Isles, and taking as a standard the average for the ten years, 1890-99.

RAINFALL AND TEMPERATURE, OCTOBER, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	1·56	— 1·03	·35	6	11	67·1	18	32·7	15	0	9
II.	Tenterden ...	1·98	— 1·01	·47	6	14	68·0	18	32·2	9	0	4
,,	Hartley Wintney ...	1·73	— 1·16	·53	6	12	66·0	18*a*	26·0	15	4	8
III.	Hitchin ...	1·13	— 1·44	·25	21	13	65·0	18, 19	28·0	14	6	...
,,	Winslow (Addington) ...	·96	— 1·73	·37	16	10	67·0	18	27·0	13, 15	3	11
IV.	Bury St. Edmunds (Westley)	1·14	— 1·52	·29	16	10	70·5	18	30·0	16	...	...
,,	Brundall ...	1·20	— 1·42	·24	1	13	66·2	19	29·4	16	1	3
V.	Alderbury ...	1·72	— 1·48	·63	6	8	60·0	11*b*	32·0	12	1	...
,,	Winterborne Steepleton ...	2·77	...	·73	2	15	65·7	18	31·7	13	1	10
,,	Torquay (Cary Green) ...	2·05	...	·81	2	11	64·9	18	40·8	8	0	0
,,	Polapit Tamar [Launceston]	2·32	— 2·22	·74	6	17	61·8	11	30·5	26	2	3
,,	Bath ...	·71	...	·22	6	10	63·4	11	34·0	13	0	10
VI.	Stroud (Upfield) ...	·58	— 2·20	·14	16	...	64·0	18	36·0	28	0	...
,,	Church Stretton (Woolstaston)	·70	— 2·80	·22	15	14	65·5	18	37·5	13	0	...
,,	Bromsgrove (Stoke Reformatory)	·60	— 1·66	·19	16	9	65·0	18	29·0	12	6	...
VII.	Boston ...	·91	— 1·36	·24	23	9	66·0	21	30·0	15	...	...
,,	Bawtry (Hesley Hall) ...	·32	— 2·25	·15	9	7	64·0	17	26·0	17	12	...
,,	Derby (Midland Railway) ...	·55	— 1·99	·33	16	10	67·0	18	28·0	12	3	...
VIII.	Bolton (The Park) ...	2·90	— 1·66	1·21	16	...	58·9	4	35·1	3	0	3
IX.	Wetherby (Ribston Hall) ...	·72	— 2·08	·16	9	9	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	2·92	— 3·72	·85	16	13	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	·50	— 2·54	·12	9	11	65·0	11, 18	30·0	9	4	10
X.	Newcastle (Town Moor) ...	·81	— 1·91	·28	5	10	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	9·19	— 4·23	4·03	16	16	59·5	19	32·3	31	1	...
XI.	Cardiff (Ely) ...	2·69	— 1·74	·84	16	17	...	...	...	...	...	...
,,	Haverfordwest (High St.) ...	2·25	— 2·83	·95	16	15	62·5	4	33·3	25	0	7
,,	Aberystwith (Gogerddan) ...	3·23	— 2·33	1·61	16	11	71·0	27	32·0	15*d*	3	...
,,	Llandudno ...	1·29	— 2·71	·46	16	13	64·0	18	36·8	15	0	...
XII.	Cargen [Dumfries] ...	2·28	— 2·15	·72	16	10	59·0	3*c*	30·0	13, 14	3	...
XIII.	Edinburgh (Royal Observy.)	·54	...	·22	5	9	57·9	21	36·8	8	0	5
XIV.	Colmonell ...	2·59	— 1·75	·78	16	15	64·0	2	31·0	12*e*	3	...
XV.	Tighnabruaich ...	3·45	...	·76	5	18	55·0	19	32·0	12	1	1
,,	Mull (Quinish) ...	5·30	— ·27	·94	5	23	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	1·85	— 1·72	·71	6	12	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	·70	— 2·06	·40	5	11	59·7	19	29·7	13	1	...
XVII.	Braemar ...	1·29	— 2·59	·50	5	13	58·8	26	22·6	13	7	...
,,	Aberdeen (Cranford) ...	1·03	— 2·33	·30	5	15	63·0	20	27·0	12	3	...
,,	Cawdor (Budgate) ...	1·33	— 1·61	·43	5	15	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	7·07	— 2·22	1·42	5	26	57·5	21	31·0	13	...	...
,,	Bendamph ...	7·39	— 1·75	1·11	16	25	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	1·82	— 1·46	·57	5	13	62·0	4	36·5	24	0	...
,,	Castletown ...	3·27	...	·75	5	25	59·0	20	32·0	12, 13	1	...
XX.	Killarney ...	..	...	...	...	..	...	...	...	...	0	...
,,	Waterford (Brook Lodge) ...	1·74	— 2·16	·49	15	16	64·5	18	32·6	25	1	...
,,	Broadford (Hurdlestown) ...	3·15	+ ·05	1·08	16	16	60·0	21	33·0	24	0	...
XXI.	Carlow (Browne's Hill) ...	1·51	— 1·89	·57	16	17	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	·45	— 2·58	·22	16	11	64·0	21	34·3	27	0	0
XXII.	Ballinasloe ...	2·77	— ·63	1·00	16	20	66·0	5	30·0	12	4	...
,,	Clifden (Kylemore House) ...	4·92	— 3·02	2·12	16	15	...	...	...	...	...	...
XXIII.	Seaforde ...	·85	— 2·74	·24	15	16	62·0	17	26·0	10*f*	...	...
,,	Londonderry (Creggan Res.)	2·80	— 1·28	·63	22	25	...	...	...	...	...	...
,,	Omagh (Edenfel) ...	3·51	— ·40	·80	27	21	...	...	...	...	...	...

+ *Shows that the fall was above the average*; — that it was below it. *a* and 19, 21. *b* and 12, 19. *c* and 17, 18. *d* and 24, 26. *e* and 29, 30. *f* and 12 23.

SUPPLEMENTARY RAINFALL, OCTOBER, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	2·50	XI.	New Radnor, Ednol	1·38
,,	Sheppey, Leysdown	1·66	,,	Rhayader, Nantgwillt	2·97
,,	Hailsham	2·08	,,	Lake Vyrnwy	2·13
,,	Crowborough	2·80	,,	Ruthin, Plâs Drâw	1·61
,,	Ryde, Beldornie Tower	2·15	,,	Criccieth, Talarvor	1·58
,,	Emsworth, Redlands	2·46	,,	Anglesey, Lligwy	2·17
,,	Alton, Ashdell	2·12	,,	Douglas, Woodville	2·16
,,	Newbury, Welford Park	1·60	XII.	Stoneykirk, Ardwell House	2·13
III.	Harrow Weald	1·62	,,	Dalry, Old Garroch	3·70
,,	Oxford, Magdalen College	·74	,,	Langholm, Drove Road	2·57
,,	Banbury, Bloxham	·61	,,	Moniaive, Maxwelton House	2·24
,,	Pitsford, Sedgebrook	·67	,,	Lilliesleaf, Riddell	·96
,,	Huntingdon, Brampton	1·14	XIII.	N. Esk Reservoir [Penicuick]	1·40
,,	Wisbech, Bank House	1·35	XIV.	Maybole, Knockdon Farm	1·67
IV.	Southend	2·04	,,	Glasgow, Queen's Park	1·73
,,	Colchester, Lexden	·75	XV.	Inveraray, Newtown	5·69
,,	Saffron Waldon, Newport	1·13	,,	Ballachulish, Ardsheal	6·45
,,	Rendlesham Hall	1·01	,,	Campbeltown, Redknowe	2·84
,,	Swaffham	1·14	,,	Islay, Eallabus	4·45
,,	Blakeney	1·25	XVI.	Dollar	1·54
V.	Bishop's Cannings	1·37	,,	Balquhidder, Stronvar	4·29
,,	Ashburton, Druid House	2·82	,,	Coupar Angus Station	·96
,,	Okehampton, Oaklands	3·09	,,	Blair Atholl	·91
,,	Hartland Abbey	3·48	,,	Montrose, Sunnyside	·78
,,	Lynmouth, Rock House	2·50	XVII.	Alford, Lynturk Manse	1·15
,,	Probus, Lamellyn	2·38	,,	Keith, H.R.S.	2·15
,,	Wellington, The Avenue	1·55	XVIII.	Fearn, Lower Pitkerrie	1·65
,,	North Cadbury Rectory	2·77	,,	S. Uist, Askernish	...
VI.	Clifton, Pembroke Road	1·37	,,	Invergarry	3·85
,,	Moreton-in-Marsh, Longboro'	·86	,,	Aviemore, Alvie Manse	1·83
,,	Ross, The Graig	·55	,,	Loch Ness, Drumnadrochit	1·74
,,	Shifnal, Hatton Grange	·83	XIX.	Invershin	2·38
,,	Wem Rectory	·76	,,	Altnaharra	2·94
,,	Cheadle, The Heath House	1·16	,,	Bettyhill	3·09
,,	Coventry, Kingswood	·57	,,	Watten, H.R.S.	1·70
VII.	Market Overton	·64	XX.	Cork, Wellesley Terrace	3·06
,,	Market Rasen	·69	,,	Darrynane Abbey	5·39
,,	Worksop, Hodsock Priory	·32	,,	Glenam [Clonmel]	2·30
VIII.	Neston, Hinderton	1·27	,,	Ballingarry, Hazelfort	2·26
,,	Southport, Hesketh Park	1·99	,,	Miltown Malbay	4·24
,,	Chatburn, Middlewood	2·46	XXI.	Gorey, Courtown House	1·23
,,	Duddon Valley, Seathwaite Vic.	4·64	,,	Moynalty, Westland	1·64
IX.	Langsett Moor, Up. Midhope	1·10	,,	Athlone, Twyford	3·23
,,	Baldersby	·57	,,	Mullingar, Belvedere	2·50
,,	Scalby, Silverdale	·79	XXII.	Woodlawn	3·47
,,	Ingleby Greenhow	·53	,,	Westport, Murrisk Abbey	3·65
,,	Middleton, Mickleton	1·03	,,	Crossmolina, Enniscoe	2·98
X.	Beltingham	·67	,,	Collooney, Markree Obsy	2·68
,,	Bamburgh	·93	XXIII.	Enniskillen, Portora	2·57
,,	Keswick, The Bank	3·10	,,	Warrenpoint	·87
,,	Melmerby Rectory	1·55	,,	Banbridge, Milltown	·67
XI.	Llanfrechfa Grange	1·38	,,	Belfast, Springfield	1·26
,,	Treherbert, Tyn-y-waun	5·45	,,	Bushmills, Dundarave	2·56
,,	Llandovery, Tonn	...	,,	Stewartstown	1·55
,,	Castle Malgwyn	1·79	,,	Killybegs	3·42
,,	Llandefaelog-fach	1·98	,,	Horn Head	...

METEOROLOGICAL NOTES ON OCTOBER, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm. R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The weather was generally of an anticyclonic type and fairly free from R, although mostly lacking in sunshine. The first eleven days were dull with some fog, especially the 11th, when it was very dark at times. From 12th to 15th it was fine and bright and cooler, but it became heavy and foggy again from 16th to the last week, which was somewhat finer and cooler. Duration of sunshine 56·2* hours and of R 54·2 hours. Mean temp. 51°·0, or 1°·2 above the average.

TENTERDEN.—Warm, and decidedly dry after the first week. Duration of sunshine only 100·6† hours. Dull from 17th to 24th, with fog all day on 19th.

CROWBOROUGH.—Cool and pleasant on the whole, with gales on 5th and 17th. Mean temp. 50°·0.

HARTLEY WINTNEY.—Extremely pleasant, summer weather continuing into the third week, and unusually high temp. The last week was colder and foggy.

ADDINGTON MANOR.—Very fine, with the smallest R in any October except three during 34 years.

PITSFORD.—Very fine, bright and still. R 2·35 in. below the average. Mean temp. 47°·6.

BURY ST. EDMUNDS.—A lovely mild autumnal month, with R much below the average. Water became scarce and ponds were nearly dry.

BRUNDALL.—A very fine month. Mean temp. 1°·8 above the average, and max. above 60° on ten days.

TORQUAY, CARY GREEN.—R 1·99 in. below the average. Duration of sunshine 90·6* hours, or 23·4 hours below the average. Mean temp. 53°·7 or 1°·8 above the average. Mean amount of ozone 4·4. Max. 9·0 on 3rd with E.N.E. wind, min. 2·0 on several days.

LYNMOUTH.—Mild with an average amount of sunshine till 23rd. No violent gales or extremes of temp. All the heavy R fell in the night.

WELLINGTON.—Remarkably fine and dry, with little rough weather. R only about half the normal.

NORTH CADBURY.—Temp. very equable throughout, the latter half of the month being the warmer. There was no strong wind.

CLIFTON.—Mostly anticyclonic, and with the exception of a rainy spell from 5th to 10th and on 16th and 17th, and of S.W. gales on 5th and 17th, a fine calm and pleasant month. Some fog in the last week. R little more than one-third of the average.

ROSS.—The driest October in 86 years, except in 1830, when ·53 in. fell, and a perfect contrast to 1903, when R fell on every day amounting to 7·40 in. Most tender plants were uninjured at the close and the autumn tints were exceedingly beautiful.

WOOLSTASTON.—Exceptionally warm and dry. On the 22nd there was an earthquake at 10·45 p.m., followed by a slighter shock between 2 and 3 a.m. on the following morning. The noise resembled that made by a heavy dray.

BOLTON.—Fair and mild, with sunshine slightly above the average. Except for a N.W. gale on 5th and 6th the winds were very light. Slight fog occurred on four days and night mists were frequent in the latter part, which probably had much to do with causing the singularly mild weather.

SOUTHPORT.—Dry and sunny with unusually high bar. pressure. Mean temp. 1°·7 above the average. Duration of sunshine 21 hours above the average. R 1·92 in. below the average, and underground water-level unusually low.

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* Campbell-Stokes. † Jordan.

HULL.—Very light R and some fine mild weather. Stormy on 5th and 6th. Fog frequently.

NEWCASTLE.—The lowest R in October since 1868, except ·63 in. in 1879, whereas 1903 had the greatest amount, 9·24 in.

LLANFRECHFA GRANGE.—Calm, with gradually falling temp. and some fog. The R fell chiefly at night, and the weather was very favourable for agriculture.

HAVERFORDWEST.—Fine and mild, with small R and generally high temp. The wind reached the force of a gale on 3 days, but the last 10 days were calm. Duration of sunshine 71·7* hours.

DOUGLAS.—A singularly beautiful month and certainly the best October for 30 years, with moderate R, unusual calmness and excess of sunshine. Temp. above the average in the last two weeks. Gales on 5th and 16th.

SCOTLAND.

CARGEN [DUMFRIES].—One of the driest and warmest Octobers on record. A truly "record" year in matters agricultural.

LILLIESLEAF.—Lovely weather, like a cool summer, with little R, and splendid for getting in potatoes, of which there was a capital crop.

COLMONELL.—The first woek was rather stormy, with a strong gale on 5th and 6th. Mean temp. 48°·8, or 2°·2 above the average of 28 years.

MULL, QUINISH.—The R fell generally at night, and the weather showed a wonderful aptitude for clearing up. Very mild from 18th to 21st and at the end. N.W. gale on 4th.

ABERDEEN.—Fine and dry, with light wind from W. and S.W. and much sunshine.

DRUMNADROCHIT.—The R was less than half the average of 18 years and the lowest in October in that period.

ALTNAHARRA.—Exceptionally fine, mild and dry, and particularly calm, mild and clear towards the end.

CASTLETOWN.—Strong winds from W. till 10th, with heavy showers of R and often H. From 23rd to the end, high bar., overcast skies, damp atmosphere and light variable winds. Much cloud throughout.

IRELAND.

DARRYNANE ABBEY.—Fine on the whole with some very fine days especially in the latter half. R 9·3 per cent. below the average of 25 years. More than half the total fell on 3 days.

DUBLIN.—Dull, yet fine and mild, with high bar., a deficiency of bright sunshine and a damp atmosphere but a singularly scanty R, which established a record drought for October. There was very little cold weather, but transitory cold snaps on 3rd, 13th and 27th, connected with anticyclonic conditions.

MARKREE OBSERVATORY.—A very dry month. The nights were generally cloudy and the weather mild and fine on the whole.

BANBRIDGE.—R 2·33 in. below the average of 40 years, and the least since the gauge was established in 1862.

OMAGH.—Although the R was close to the average it fell mostly at night and was accompanied by anticyclonic conditions and temp. above the average throughout. It therefore left the feeling that for many years so agreeable an autumn month has not been experienced. The natural maturing of the tints, owing to the almost complete absence of frost, resulted in a display of foliage not often equalled.

* Campbell-Stokes.

Climatological Table for the British Empire, May, 1904.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	76·6	16	34·1	9	63·4	46·7	47·8	80	123·4	28·0	1·96	16	7·3
Malta	90·2	23	52·3	1	78·9	58·4	59·1	78	138·1	48·9	·00	0	1·4
Lagos, W. Africa	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	75·6	4	44·9	15*b*	65·1	51·5	52·6	82	...	...	3·37	14	5·0
Durban, Natal	91·2	7	50·4	10	79·2	58·2	...	...	143·1	...	·44	8	2·0
Mauritius	81·7	1	57·1	31	79·0	64·9	65·1	81	142·1	50·1	3·59	18	4·5
Calcutta	98·1	19	68·1	12	93·3	76·7	74·9	75	156·0	67·6	9·84	7	5·1
Bombay	92·3	30	78·2	1	91·2	81·0	75·9	73	141·0	72·8	·02	1	2·9
Madras	102·7	14	74·6	24	95·9	79·4	74·0	71	147·6	71·6	·92	3	4·0
Kodaikanal	76·3	3	51·6	7	68·4	54·3	51·6	74	146·1	42·6	7·64	26	6·2
Colombo, Ceylon	89·4	8	68·5	23	86·7	78·1	75·2	83	152·8	66·0	9·27	19	7·0
Hongkong	88·7	2	63·1	7	80·8	71·8	70·2	83	137·9	...	7·71	16	7·3
Melbourne	77·8	13	35·9	25	61·4	46·5	47·2	75	132·9	28·9	2·56	16	5·7
Adelaide	81·7	13	36·9	24	67·3	49·9	48·4	71	132·8	29·7	3·00	13	4·0
Coolgardie	83·0	10*a*	33·8	28	67·4	47·2	43·6	61	148·4	25·8	1·51	9	5·2
Sydney	76·2	6	44·4	25	65·2	53·9	51·6	84	112·0	33·0	5·20	28	5·5
Wellington	68·2	10	38·9	4	59·9	46·2	45·0	74	117·0	34·0	4·59	15	6·7
Auckland	66·0	24	42·0	29	61·8	50·3	50·0	72	122·0	29·0	1·01	10	5·0
Jamaica, Negril Point	87·8	31	68·7	27	85·3	73·0	72·1	75	...	...	6·45	8	...
Trinidad	91·0	13	65·9	9	87·8	68·6	71·8	80	163·0	62·0	2·76	13	...
Grenada	86·4	19	71·6	21	83·6	73·8	69·3	73	146·0	...	3·26	15	3·0
Toronto	76·9	25	35·0	11	64·4	46·4	46·7	72	106·2	26·8	3·80	11	5·7
Fredericton	80·8	8	30·0	2	67·1	42·2	40·1	56	...	...	4·16	10	5·6
Winnipeg	84·0	20	22·0	14	67·3	39·7	...	...	...	...	1·77	8	5·0
Victoria, B.C.	73·2	12	40·3	1	59·7	46·0	...	...	...	...	·49	9	6·0
Dawson	67·5	31	25·0	7	55·5	34·7	...	...	...	...	·96	7	4·4

a and 12. *b* and 25.

MALTA.—Mean temp. of air 66°·8 or 2°·8 above the average. Mean hourly velocity of wind 2·9 miles below average. Mean temp. of sea 69°·1.

Mauritius.—Mean temp. of air 0°·7, dew point 0°·2, and R ·11 in. below averages. Mean hourly velocity of wind 8·0 miles, or 2·3 below average.

MADRAS.—Temp. below normal; R below average. Bright sunshine on 197·2 hours, or 51·2 per cent. of possible; T8 on 2 days; dust storm on 7th.

KODAIKANAL.—Bright sunshine 162 hours; numerous T8S, many with H.

COLOMBO.—Mean temp. of air 81°·9, or 0°·5 below, of dew point 0°·2 below, R 2·85 in. below, averages. Mean hourly velocity of wind 9 miles, prevailing direction S.W.

HONGKONG.—Mean temp. of air 75°·6. Sunshine 148·0 hours. Mean hourly velocity of wind 12·8 miles, prevailing direction E. by S.

Adelaide.—Mean temp. of air 1°·0 above, R ·26 in. above averages for 47 years.

Wellington.—Mean temp. of air 1°·5 above, and R 4·36 in. below, averages.

TRINIDAD.—R 1·17 in. below the 40 years average.

Symons's Meteorological Magazine.

No. 467. DECEMBER. Vol. XXXIX.

THE FROST AND SNOW OF NOVEMRER, 1904.

Winter commenced with unusual suddenness and intensity in the beginning of the last week of November, when more snow fell in London at any rate than during the whole of the winter 1903–4. After three weeks of mild, gloomy and in places foggy weather, a week of wintry conditions set in over the whole country. Coincident with the passage of a cyclonic system over the British Isles in an easterly direction on the 21st, there was a spell of sharp frost, accompanied in most places by snow. In London the temperature began to fall decidedly on the 21st, and from that date frost occurred nightly at Camden Square until the 29th. The lowest air temperature recorded was 24°·1 in the screen on the morning of the 26th and the lowest radiation temperature 16°·5 on grass on the 27th, though a lower grass reading might have been obtained on the 23rd had the thermometer not been covered by snow. The maximum temperature was as low as 33°·2 on the 24th, on which day the mean temperature only reached 28°·8. A slight sprinkling of snow fell in London on the morning of the 22nd, and from 10 to 11.30 p.m. on the 23rd it snowed heavily, rather more than an inch falling, and this continued to lie on the ground melting very slowly till the 30th.

The frost was felt with much greater severity over large tracts of Great Britain than in London, and several instances of temperatures below 10° have been reported. In the following notes we take advantage of the observations published by the Meteorological Office as well as those reported by rainfall observers. The earliest notably low readings occurred at Wick and Nairn, which registered 15° and 12° respectively on the morning of the 22nd. On the 23rd minimum readings were reported of 6° at Bromsgrove and 13° at Derby; on the 24th, 6° again at Bromsgrove and Winslow, 11° at Ross, 12° at Boston and 13° at Nottingham; on the 25th, 6°·9 at Polapit Tamar, near Launceston, and 15° at Nottingham; and on the 26th, 7°·3 at Braemar. At Hodsock Priory, Worksop, a reading of —1°·9 on grass was recorded on the 24th, and at Winslow 2°·0 on the same day. The frost seems to have been felt in its greatest severity over the English Midlands, where it is generally referred to as the most severe in November for at least twenty years; at Bassingham, in western Lincolnshire, it is said to have been unparalleled since the Crimean

winter of 1854. The temperatures quoted above, though believed to be taken by accurate instruments, cannot all be absolutely relied on, and we may here repeat the warning that so few amateur observers regard—namely, that a minimum thermometer without a Kew certificate is not worth reading or recording. In spite of the severity of the frost, skating and curling were only possible in a few localities owing to the short duration of the cold weather.

Snow commenced in the north of Scotland on the 19th and in a few places in the extreme north on the 18th. It became fairly general over Scotland, the greater part of Ireland and the north of England on the 20th, continuing on the 21st and 22nd and coming further south each day. With the exception of a strip along the south coast of England, where no snow fell, practically the whole of the kingdom had a heavy fall on the 23rd, and in the Highlands and Northumberland it fell again on the 24th and in a few instances on the 25th. The total depth varied from nothing in the south and south-east of England and not much more than an inch in the neighbourhood of London to as much as 18 inches in the Lake District, where drifts 10 feet deep were heaped up in some places. Considerably more than a foot fell over the Derbyshire uplands, sometimes drifting to 6 and 7 feet, while in the valleys the average depth was about 8 inches. Some 20,000 quarrymen and outdoor workers are said to have been thrown out of employment in the Peak District. Over the northern counties of England and the south of Scotland 8 or 9 inches seems to have been general, and 14 inches is reported at Beltingham, near Haltwhistle, 13 inches at Langholm and a foot at Castle Douglas.

Railway traffic was seriously disorganized, the drifts reaching 5 and 6 feet in depth, and trains had in some cases to be dug out. Several parishes in Scotland missed the usual postal delivery on the 22nd, and at many places the storm formed almost a blizzard on the night of the 21st, and so rapid was the fall that near Arbroath, from 9 to 18 inches fell in an hour or two. In consequence, many sheep were lost on the hills, and shepherds were obliged to search for them with the help of long poles. The heavy fall was mainly confined to the inland country, and on the coast from Anglesey to Lancaster the amount was trifling. At Bamburgh, some ten miles south of Berwick, the ground was never white for more than a few hours at a time. In the southern part of England, and in Wales, the heaviest falls took place over Snowdonia, the Radnor Hills, where 5 inches fell, and in the Cornish peninsula, where 3 inches fell on the west coast, a locality in which snow is a rare phenomenon. At Liskeard 7 inches was the depth, and at Tavistock 3 or 4 inches. About 3 inches also fell at Birmingham, and at Alcester drifts were several feet deep on the 22nd. Little snow fell in North Devon (except on Exmoor), Somerset, Wilts, Dorset, South Hampshire, and the greater part of Kent, and from 1 to 2 inches was general over the *remainder* of the country. The fall was fairly uniform over Ireland,

varying from some 2 inches in the south-west to very little at Westport.

We have made an attempt to represent the snowfall on a map, but have not received a sufficient number of definite statements as to the depth which fell, to make it worth publishing. If those of our readers who have not reported the depth of undrifted snow on the ground between November 19th and 24th will send in the information it may be possible to complete the map for publication in *British Rainfall*, 1904.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE SEVERE COLD IN NOVEMBER, 1904.

YESTERDAY (November 24th) was the coldest day in my memory or registers, the nearest approach to such severity in November being November 24th, 1858. This, though very severe also, did not equal 1904 by several degrees. Other low temperatures here occurred on November 30th and December 1st, 1896, and November 27th and 28th, 1890, as the following comparison will show. The instruments in Stevenson's screen were tested by Mr. Marriott this year, and on the other two occasions had been recently properly corrected, so that you may consider them as very closely accurate :—

	Max.	Min.	Mean.	Grass.	Wind.	Snow or Rain. in.	Weather.
Nov. 30, 1896	35°0	20°5	27°75	17°7	N.E. 1	·00	Cloudless, freezing all day.
Dec. 1, 1896	38·8	21·0	29·90	20·5	N.E. 1	·17	Cloudy, rain even.
Nov. 27, 1890	32·0	22·8	27·40	18·0	N.E.E. 1	·018	Cloudless, snow evening.
,, 28, 1890	30·7	25·1	27·90	21·0	N.N.E. 1	·078	Thickly overcast.
,, 24, 1904	30·0	11·1	20·55	Grass ther. covered snow.	N.W. 1	·108	Ground covered 2 inches snow.
,, 25, 1904	37·0?	13·9	?	?	...	...	Ditto, warmer midday.

I notice in *Meteorological Magazine*, 1890, page 161, that the lowest temperatures in November at Camden Square are given, but that then in a small district in Surrey lower temperatures were recorded than here at Ross in 1904, especially at Shirley and Addington.

This year the region of lowest readings would probably lie in a small area with Worcester as its approximate centre ; but the only readings I have noticed are at Worcester and Leicester, apparently one degree each colder than Ross.

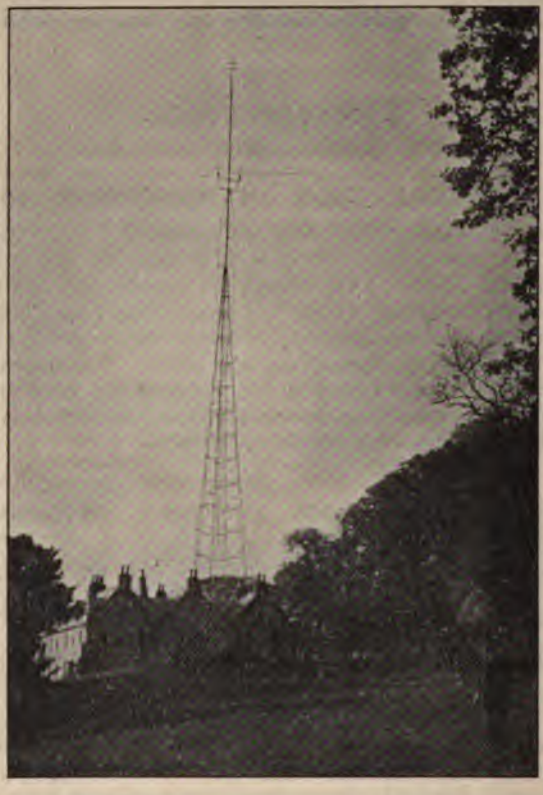
We had a heavy squall of rain passing rapidly over us about 3 to 4 p.m. on Tuesday, 22nd, and a fall of snow of about two inches Wednesday, 23rd, followed by the severe frost with fog on the 24th.

HENRY SOUTHALL.

The Graig, Ross, Herefordshire, Nov. 25th, 1904.

THE TALLEST ANEMOMETER POST.

ALONG with this I send you the photograph of a steel flagstaff I have erected at Riddell for my instruments, which might interest some of your readers if a photogravure was made of it for the Magazine.



STEEL FLAGSTAFF AT RIDDELL, LILLIESLEAF, N.B.

The flagstaff was exhibited at the last Glasgow Exhibition, and it seemed to me so suitable that I purchased and erected it at one corner of the bowling green in front of my house. It has been up a year now. It is most beautifully made, extremely graceful, and of the finest possible material. From the bowling green to the top is 130 ft., which, I am told, is the highest flagstaff in the United Kingdom. On the lower rail is the following inscription:—"In *Memoriam*. This flagstaff, a steel one, which was made in Canada

and exhibited at the Glasgow Exhibition of 1901, was purchased by Lieut.-General Sprot of Riddell, and erected by him on this site on the 22nd of August, 1903, to commemorate the Coronation of King Edward VII. on the 9th of August, 1902, and his coming to Edinburgh with his Queen and Court in May, 1903, and there holding a Levee at Holyrood."

Some 16 or 18 years ago I requested Messrs. Yeates & Son to make me two instruments—a weathercock (the history of which may be interesting) and an anemometer. These I placed on two long larch poles about 40 ft. high, 6 ft. apart, and for convenience coupled them together near the top by three bars, on which the men stood to erect the instruments and otherwise attend to them. Both these instruments are connected to dials on my business-room mantelpiece. The "Robinson" cups have a dial so arranged that when the electricity is at any time switched on, the velocity of the wind at the time is indicated on the dial, while the time is taken with the chronograph which is habitually carried by me.

It was in 1877 that I found myself as Assistant Adjutant and Assistant Quartermaster-General for Scotland quartered in Edinburgh, where, near the convent at Warrender Place, I bought a small house. All my life I have been taking notes in some way or another of rain and wind, and so forecasting for my own convenience by the aid of barometer, thermometer, &c., the probable weather. When I bought my new house it occurred to me I would like a weathercock (or vane) on the top, with a dial inside the house, and the first thing I thought of was a powerful vane turning a spindle going right down through the roof and turning the arrow on the dial by means of bevel wheels. But on second thoughts it seemed to me noisy and clumsy, so I worked out in my mind a weathercock so arranged with contact parts that by means of four electric wires the four points of the compass would be brought up on the dial.

Nowhere, however, could I find such a thing either in London or Edinburgh. At last the great Electric Exhibition took place in Paris, and the following year at Sydenham. Being by this time quartered at Kingston-on-Thames, in command of the South London Brigade, I hied me on my bike to the Crystal Palace one day with my sketches and specifications in my pocket, and at every likely stall made enquiry for what I was in search of; but as in Edinburgh and London, so there, no such thing I was assured had ever been heard of. Perhaps a year or so afterwards, at a show of some sort in the Agricultural Hall, I found an instrument approaching what I required, but not sufficiently perfect to be of any good, and the first successful one that ever came to my notice was erected in the entrance hall of the Constitutional Club. However, instead of four connections this was worked with eight points of the compass, and I rejected it because it seemed too complicated; and that it afterwards proved itself to be, for it soon got out of order, and though it has been repaired more than once, it is seldom or never

working properly. Ultimately I found just what I required depicted in one of Messrs. Yeates & Sons' illustrated catalogues. There are four letters, N., E., S. and W., and when a button is pressed up flies one or two of these letters ; if two fly up at a time, such as N. and W., that indicates north-west. So altogether I have eight points of the compass for my four wires and one return.

There is an ordinary weathercock with the four letters at the end of rods on the top of the flagstaff, which is now no longer used for flying a flag, and a little bit below the top is a pair of crosstrees on which the two before-named instruments are fixed, and it is arranged hereafter to erect two more wind instruments at the same level on crosstrees at right angles to those now up.

In addition to the above-named instruments I have on my mantelpiece a recording rain gauge which registers every hundredth (·01) of an inch of water that falls, so that at any minute on a dark winter's night it is easy to see what is going on outside, and this instrument has the further advantage that each time it records ·01 in. it gives a loud "click," so that when I am sitting reading I not only am made aware that it is raining more or less heavily, but by paying attention for a short time can tell how fast it is raining without leaving my chair.

I trust that this letter will be of some interest to your readers.

J. SPROT (Lt.-General).

Riddell, Lilliesleaf.

THE CLOSING OF THE BEN NEVIS OBSERVATORIES.

As we intimated last month, the meteorological observatories on the summit of Ben Nevis, 4,400 feet above sea level, and at Fort William, practically at the level of the sea, were closed on October 1st, 1904. We look upon this as a misfortune, and can only avoid the old and unsatisfactory explanation that someone has blundered, by adopting the older and less satisfactory explanation that several people have blundered. The blunder has been made, and it has been intensified by some well-meaning, but ill-advised, writers and newspapers trying to make the cessation of the observatories a Scottish grievance. The Directors of Ben Nevis Observatory very properly repudiate any such suggestion. It was a splendid and public-spirited act on the part of the Scottish people to render so substantial and considerable a service to science as the founding and support of a high level observatory at the highest possible level ; but the fact that they did so does not make the observations of more value to Scotland than to England ; indeed, it would seem that they were of most value to Germany, for the German Weather Bureau alone appears to have utilised the daily results. We look upon the loss as a loss to science, and if any one set of conditions can be blamed for it we must blame the narrow views of the public of every section of the country, of Parliament and of the Govern-

ment in looking at scientific research in a local or a merely utilitarian light.

The harm has been done in the present instance: the records are broken beyond the power of "all the king's horses and all the king's men" to put together again, and there is time enough to think of starting afresh when we know how the recommendations of the Treasury Committee as to the Meteorological Office are to be treated by the Government. Meanwhile, we publish a full abstract of the last complete year's work of the abandoned observatories.

Report of the Committee of the British Association, consisting of LORD MCLAREN, PROFESSOR A. CRUM BROWN (*Secretary*), SIR JOHN MURRAY, DR. ALEXANDER BUCHAN, *and* MR. R. T. OMOND. (*Drawn up by* DR. BUCHAN.)

The results of the observations made at the two Observatories during 1903 are detailed in the following Table.

1903	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR
Mean Pressure in inches.													
Ben Nevis Obs.	25·099	25·148	24·915	25·232	25·325	25·555	25·360	25·189	25·405	24·925	25·315	25·056	25·210
Fort William..	29·720	29·726	29·475	29·845	29·863	30·088	29·847	29·659	29·924	29·410	29·915	29·650	29·760
Differences..	4·621	4·578	4·560	4·613	4·538	4·533	4·487	4·470	4·519	4·485	4·600	4·594	4·550
Mean Temperatures.													
Ben Nevis Obs.	22°7	27°3	24°6	24°5	33°4	38°7	39°8	37°6	37°3	31°7	28°3	24°2	30°8
Fort William .	38·5	43·2	41·5	42·7	49·7	55·9	55·1	53·9	53·6	47·8	43·5	38·5	46·8
Differences..	15·8	15·9	16·9	18·2	16·3	15·2	15·3	16·3	16·3	16·1	15·2	14·3	16·0
Extremes of Temperature: Maxima.													
Ben Nevis Obs.	35·7	42·3	37·0	35·0	56·0	58·0	49·6	49·0	50·0	40·5	41·9	36·6	58·0
Fort William..	50·4	55·6	56·5	57·6	71·5	76·0	71·1	63·8	68·0	60·0	55·5	54·0	76·0
Differences..	14·7	13·3	19·5	22·6	15·5	18·0	21·5	14·8	18·0	19·5	13·6	17·4	18·0
Extremes of Temperature: Minima.													
Ben Nevis Obs.	7·7	17·0	14·9	12·6	15·7	22·8	27·7	31·0	24·3	22·8	10·9	13·3	7·7
Fort William..	21·3	32·1	32·3	29·6	33·4	36·2	40·6	42·2	35·8	31·0	23·5	22·4	21·3
Differences..	13·6	15·1	17·4	17·0	17·7	13·4	12·9	11·2	11·5	8·2	12·6	9·1	13·6
Rainfall in inches.													
Ben Nevis Obs.	33·45	36·24	37·95	8·36	6·61	6·44	13·26	20·97	10·72	18·66	17·27	6·81	216·74
Fort William..	16·12	17·04	17·25	3·81	4·49	2·97	6·60	11·95	7·15	13·05	7·85	5·61	113·89
Differences..	17·33	19·20	20·70	4·55	2·12	3·47	6·66	9·02	3·57	5·61	9·42	1·20	102·85
Number of Days 1 in. or more fell.													
Ben Nevis Obs.	11	13	17	4	1	2	5	7	3	8	5	3	79
Fort William..	5	7	7	0	1	0	1	3	1	4	1	2	32
Differences..	6	6	10	4	0	2	4	4	2	4	4	1	47
Number of Days ·01 in. or more fell.													
Ben Nevis Obs.	22	27	28	22	19	18	23	29	18	29	22	23	280
Fort William..	21	26	31	13	16	12	21	27	21	29	22	20	259
Differences..	1	1	—3	9	3	6	2	2	—3	0	0	3	21
Mean Rainband (Scale 0—8).													
Ben Nevis Obs.	1·4	2·4	2·0	2·0	2·3	3·6	2·7	2·6	2·5	3·3	2·5	1·5	2·4
Fort William..	3·6	4·8	3·9	3·1	3·8	4·7	4·7	4·7	4·0	4·5	4·0	3·4	4·1
Differences .	2·2	2·4	1·9	1·1	1·5	1·1	2·0	2·1	1·5	1·2	1·5	1·9	1·7

1903.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Number of Hours of Bright Sunshine.													
Ben Nevis Obs.	16	5	11	40	79	137	76	23	67	16	21	18	509
Fort William..	22	10	39	120	135	178	141	91	126	36	21	15	934
Differences..	6	5	28	80	56	41	65	68	59	20	0	+3	425
Mean Hourly Velocity of Wind in Miles.													
Ben Nevis Observatory ...	22	17	17	11	11	9	11	12	20	18	9	19	15
Percentage of Cloud.													
Ben Nevis Obs.	88	98	95	80	82	74	86	95	80	96	89	83	87
Fort William..	73	88	85	74	73	68	75	83	66	89	80	77	78
Differences..	15	10	10	6	9	6	11	12	14	7	9	6	9

At Fort William the mean atmospheric pressure was 29·760 in., or ·098 in. below the average of thirteen years; whilst the mean at the top was 25·210 in., or ·090 in. below the average of twenty years. The mean difference for the two Observatories was 4·550 in., the mean monthly difference varying from 4·621 in. in January to 4·470 in. in August. At both places the mean for the year was considerably lower than any hitherto recorded, and only in June, September and November were the monthly means above their normals. The means for October were much lower than any yet recorded for that month, the deficiency at Fort William being as much as ·365 in. At the top the absolutely highest pressure for the year was 25·941 in. at 2 p.m. on May 26th, and the lowest 23·916 in. at 5 a.m. on February 27th. At Fort William the extremes were 30·572 in. at 10 a.m. on November 6th, and 28·326 in. at 6 a.m. on February 27th. The extreme range on Ben Nevis was, therefore, 2·025 in., and at Fort William 2·246 in.

The most remarkable features of the year as regards temperature were the low temperatures for April and the cold weather of the summer months. At both Observatories the April mean temperatures were the lowest recorded for that month since 1891, the shade minimum at Fort William registering frost from 12th to 18th, and on 22nd and 24th; whilst on Ben Nevis the minimum fell to 12°·6 on 17th, and the maximum rose above the freezing point on only 11 days of the month, the highest shade reading there being no higher than 35°·0, on the 6th and 9th. The absolutely highest temperature for the year at Fort William was 76°·0 on June 7th, and at the top 58°·0 on the same day; the lowest at Fort William being 21°·3 on January 13th, and at the top 7°·7 on January 10th.

In the next table are given the lowest observed hygrometric readings at the top of Ben Nevis (reduced by means of Glaisher's Tables):—

1903	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Dry Bulb	19·1	42·2	22·6	16·1	42·0	47·3	39·8	42·7	46·6	31·0	23·0	21·0
Wet Bulb	15·3	32·0	18·1	14·1	32·0	33·5	30·9	32·8	30·3	25·6	19 0	15·7
Dew-point.....	-12·4	20·2	-10·7	-1·3	20·0	18·3	19·3	20·9	16·9	11·0	-6·2	-20·9
Elastic Force	·024	·109	·025	·041	·108	·099	·104	·112	·093	·071	·032	·016
Relative Humidity	23	41	21	46	40	30	42	41	37	41	26	14
Day of Month.....	8	9	3	18	29	5	8	1	16	18	18	29

Of these relative humidities, the lowest, 14 per cent., occurred on December 29th with a dew-point of —20°·9, that being the lowest dew-point for the year. From 9 a.m. on January 21st to noon on February 9th—that is for a period of 507 hours—the atmosphere was continuously in a saturated condition, the summit of the mountain being wreathed in fog or mist throughout the period, except for one short break of three hours. The next longest periods of continuous saturation were from April 3rd to 11th, from September 3rd to 10th, and from December 9th to 17th.

The rainfall for the year at the top was 216·74 in., or 55·97 in. above the average of 19 years; whilst the annual amount at Fort William was 113·89 in., or 35·31 in. above the average for the same period. At Fort William the year was the wettest hitherto recorded, but on Ben Nevis the amount was considerably below that for 1898, when the total was as much as 240·12 in. On Ben Nevis the totals for January, February, March and August were the largest hitherto recorded for these months, whilst the aggregate for the first three months was half the total for the year and considerably more than twice the average. At Fort William, also, about half the annual amount was registered during the first three months, whilst the aggregate for that period was more than twice the average. At the top of the mountain the greatest fall recorded on a single day was 4·78 in. on January 29th, the corresponding fall at Fort William being 1·78 in.; whilst the maximum daily amount at Fort William was 3·09 in. on January 25th, the fall at the top on that day being 3·03 in.

At the top of Ben Nevis the number of rainy days was 280, or 17 above the average, and at Fort William 259 days, or 25 above the average. The number of days on which 1 inch or more fell was much above the average at both observatories, Ben Nevis having no fewer than 79 such days, or 26 above the average, and Fort William 32, or 17 above the average. Of these days of heavy falls, as many as 41 occurred at Ben Nevis during the first three months of the year, and as many as 19 at Fort William. Considering also daily falls of between ·50 in. and ·99 in., and less heavy falls, we have the following table :—

Daily Falls of	Aggregate of Falls.		Number of Days.	
	Ben NevisObs	Fort William.	Ben NevisObs	Fort William.
1 in. and over	149·4 in.	51·3 in.	79	32
50 in. to ·99 in.....	39·0 ,,	32·1 ,,	52	46
Less than 50 in.	28·3 ,,	30·5 ,,	149	181
Total	216·7 ,,	113·9 ,,	280	259

Thus, on Ben Nevis nearly half, and at Fort William nearly one-third, of the number of rainy days had falls of ·50 in. or over, whilst at the top of the mountain such falls contributed six-sevenths of the total for the year. Again, at Fort William 45 per cent. of the annual amount, and at the high-level station nearly 70 per cent. was due to daily falls of 1 inch or over.

The sunshine recorder on Ben Nevis registered 509 hours out of a total

possible of 4,473 hours, or 11·4 per cent. of the possible sunshine, being 227 hours below the average of twenty years. This is the smallest annual amount recorded since the Observatory was opened, the next least sunny years being 1884 with 524 hours, 1886 with 571, and 1890 with 591. The amounts for February and March were the least on record for these months, and only in June, September and December were the totals above the average, and that by very small amounts. At Fort William the annual amount was 934 hours, being the smallest total in thirteen years and 185 hours below the average for that period. February, March and October had the smallest amounts on record for these months, the total of 10 hours in February being only one-fifth of the average for that month.

On Ben Nevis the mean percentage of cloud was 87, and at Fort William 78, both above the average. February, March, August and October were very cloudy months, the eye estimations of cloud amount agreeing with the small amount of sunshine registered by the sunshine recorder.

DR. W. N. SHAW ON THE GENERAL CIRCULATION OF THE ATMOSPHERE.

Dr. W. N. Shaw makes a valuable contribution to the existing knowledge of atmospheric circulation in a paper read before the Royal Society during June of the present year.* His results are derived from observations made during an investigation of the trajectories of air by means of synoptic charts, and show that the paths of air taking part in cyclonic disturbances do not always originate, as is commonly supposed, in anti-cyclonic areas, but follow a track skirting high pressure areas and traversing sometimes a very large part of a belt of the Earth in a direction more or less parallel to a line of latitude, and that the general motion of the air in middle latitudes is more or less of the nature of a passage round the poles in an easterly direction. These suggestions are confirmed by the indications of the wind charts of the South Atlantic prepared by the Meteorological Council and also by the observations of cloud movements of Hildebrandsson.

Charts have been drawn upon Mercator's projection, showing for the month of January (1) the mean surface isobars; (2) the mean isobars at an altitude of 4,000 metres, as computed by M. Teisserenc de Bort from the mean surface temperatures; (3) the isobars indicating the pressure due to the weight of the atmosphere below 4,000 metres, arrived at by deducting the pressure above 4,000 metres from that at the surface; and (4) the mean temperature at the Earth's surface. In the chart showing the pressure of the upper stratum alone the effect of cyclonic distribution is, as might be expected, practically obliterated, so that no isolated low pressure areas remain and the general trend of the isobars is in a direction

* On the general circulation of the atmosphere in middle and higher *latitudes*, by W. N. Shaw, F.R.S. *Proc. R.S.* **74** (1904), 20-30.

parallel to lines of latitude, forming complete circum-polar rings. It is shown that the air movement at high altitudes is practically parallel to the isobars, any divergences being too slight to affect the considerations put forward.

The third chart, showing the distribution of pressure of the stratum of air below 4,000 metres, gives a very remarkable result. The general trend of the lines is similar to that for the upper air, but the direction of the gradient is in every case reversed. The only noticeable point of difference in the direction of the isobars in the two charts is that in the chart for the upper stratum alone the circulation is indicated as taking place round the geographical poles, whilst in the lower stratum it seems to take place round the poles of greatest cold. This distinction is only apparent in the northern hemisphere, where the pole of greatest cold is in northern Siberia, whilst in the southern hemisphere the two poles may be assumed to coincide.

The forces represented by the average pressure distribution for January may thus be separated into that due to the stratum above 4,000 metres, which would correspond to a steady air movement from west to east, and that due to the stratum below 4,000 metres, which would produce a steady motion in the opposite direction. The superposition of the two systems gives a line of minimum pressure with a westerly flow of air on the equatorial side and an easterly flow on the polar side. This line of minimum average pressure forms the track of circular storms on the surface of the Earth. The difference of the density of air at different temperatures, together with the instability due to the condensation of water vapour, would disturb any equilibrium which could be established, and the region of minimum pressure then becomes the scene of cyclonic movements and variable winds.

Since the distribution of pressure in the lower stratum is directly dependent upon surface temperature, whereas the influence of this factor upon the pressure of the upper stratum is naturally much less marked, the effect of changes in surface temperature may be considered as changing the character of the lower stratum and leaving that of the upper stratum practically unaltered. The former are easily calculable, and we are thus in a position to apply known factors to the combination of the two systems, which forms the actual pressure at the Earth's surface. This, as the author points out, may have very important consequences with relation to classifying the facts within our knowledge of weather changes in middle latitudes.

Another conclusion pointed out is the confirmation of Sir John Murray's suggestion of the existence of a high pressure area over the Antarctic continent, since the effect of the lower component would become intensified by the extreme cold immediately surrounding the South Pole.

It is pointed out that the division of the atmosphere into upper

and lower strata at an altitude of 4,000 metres is purely arbitrary, and that it was selected because the data were already worked out by M. Teisserenc de Bort, although it is an altitude in the region of clouds of an intermediate height, and probably does not correspond to any specific discontinuity of the atmospheric layer. The isobars are not susceptible of very great accuracy at high levels, and even at the surface are not entirely to be relied upon over the oceanic areas.

The author holds out the hope of showing in a future paper that storms in the region of minimum pressure in temperate latitudes may arise from special surface conditions, and that there is at least some evidence for the correlative origin of tropical hurricanes.

The results given in the paper were confined wholly to the distribution during the month of January, but an investigation from incomplete data for July showed results in many respects similar.

ROYAL METEOROLOGICAL SOCIETY.

AT the opening meeting of the session, on November 16th, Captain D. Wilson-Barker, President, in the chair, Lieutenant Charles Royds, R.N., of the *Discovery*, gave a most interesting address on "Meteorological Observing in the Antarctic," which he illustrated with numerous lantern slides. Lieut. Royds was the officer specially charged with the meteorological observations during the recent National Antarctic Expedition.

The ship arrived at her winter quarters on February 8th, 1902, and as soon as the water in the bay was frozen, the meteorological instruments were set up on the ice. This became to all intents and purposes a land station in latitude 77° 50′ S., and observations were carried on there from April 17th, 1902, until February 15th, 1904, when the ice broke up and allowed the ship to go free.

The observations were taken every two hours, those from 8 a.m. to 10 p.m. being taken by Lieut. Royds, and the night observations being divided between the eleven officers and members of the scientific staff, each one taking a night.

The highest temperatures recorded in each year were 39° on December 26th, 1902, and 42° also on December 26th, 1903. The lowest temperature registered during the stay in winter quarters was —59°·5, on August 20th, 1903, while at Cape Armitage, a mile and a half to the south of the ship, the minimum on the same day was —64°·6. The lowest temperature registered at Cape Armitage, however, was —67°·7, at noon on July 19th, 1902.

The heaviest gale was on July 19th, 1902, when for ten hours the anemometer gave a velocity of 85 miles per hour. Blizzards were frequent and added considerably to the difficulties of observing, as the drifting snow choked up the instruments and the screens, and also stopped the self-recording instruments. A peculiarity of the

blizzards was the invariable rise of temperature; and they always came from the south and south-west.

It has sometimes been supposed that the sun seldom showed itself in the Antarctic regions. Lieut. Royds, however, said that this was utterly wrong, as day after day there were most glorious clear skies and continuous sunshine. In proof of this he showed a lantern slide of three cards from the Campbell-Stokes recorder which had traces of 24 hours' continuous sunshine.* The effect of the sun on the explorers' faces was very marked. During the winter, from living in artificial light, their faces turned yellow and various other colours. but when they went away sledging and were out in the sunshine for nine or ten hours every day, their faces turned absolutely brown and their lips cracked, while the skin blistered, and in many cases the face became swollen.

Lieut. Royds said that he had never seen such beautiful and striking examples of every sort of cloud as south of the Antarctic circle. Mirage was common, and so were halos and coronæ—some of which were very beautiful and complicated. Auroræ were not uncommon, but they were not so highly coloured nor so brilliant as those seen in the Arctic regions.

Mr. F. J. Brodie read a paper on the "Decrease of Fog in London during recent years." He had tabulated the number of days of fog reported at Brixton, the London station of the Meteorological Office, for the 33 years 1871—1903, and found that the mean annual number of fog days was 55, of which 45 occurred in the winter half of the year and only 10 in the summer half. December was the foggiest month with 9·5, the next being November with 8·5, January with 8·2, and October with 7·8. The clearest months were July with 0·4, June with 0·6, and May with 0·8. The greatest number of fog days were 86 in 1886, and 83 in 1887; and the least 13 in 1900, and 26 in 1903. Dividing the 33 years into three periods of 11 years each, the author showed that the mean for 1871—1881 was 55, for 1882—1892 it was 69, while for 1893—1903 it was only 41; there being thus a very marked decrease in the number of days with fog during the last 11 years.

The discussion on Mr. Brodie's paper was postponed till the next meeting, on December 21st.

During the evening the following gentlemen were elected Fellows of the Society:—Mr. G. W. Chilvers; Mr. G. M. Clark, M.A.; Rev. J. N. Cushing, D.D.; Mr. C. Dales; Mr. W. B. A. Dingwall; Mr. J. H. Field, B.A., B.Sc.; Mr. C. B. Goodyer; Mr. J. S. Hill, B.A., B.Sc.; Mr. E. Lewys Lloyd, M.R.C.S; Mr. T. Midgley; Mr. G. F. Nightingale; Mr. G. Paul; Mr. R. W. Smith, Jun.; and Mr. C. H. Timmler.

* It may be mentioned that one of the officers of the *Terror*, which visited the Antarctic seas in 1840-43, was so impressed with the exquisite clearness of the fine days in the far South that he strongly advocated the selection of Victoria Land as the site of a station for observing the Transits of Venus.—Ed. *S.M.M.*

REVIEWS.

The Survey Atlas of England and Wales. Designed by and prepared under the direction of J. G. BARTHOLOMEW, F.R.S.E., F.R.G.S. Drawn, Engraved, Printed and Published by the Edinburgh Geographical Institute under the patronage of the Royal Geographical Society. 1903 [1904]. Size 18 × 12½. Price £3 10s.

GEOGRAPHY is so essential to the comprehension of climatology and is so intimately concerned in the relations of air, sea and land, that even although the Atlas before us contained no section dealing directly with climate we should still consider it an appropriate subject for a review in these pages. The Atlas consists of eighty-four plates of maps and plans with descriptive text. The earlier maps deal with England and Wales as a whole, and they present some features of remarkable interest. First comes a map showing by appropriate colouring the general build of the country, expressing the contrast between highland, hill and plain in a very effective way. It was found that while there was no feature of the surface of England too small to have a name of its own, some of the features which are prominent in this map were too large to have any one name throughout their whole extent, though their unity made it desirable that they should have one; accordingly some names had to be devised or adapted, and this was done with the approval of the Royal Geographical Society. Maps of monthly temperature and rainfall show the general seasonal changes in a satisfactory way, and could scarcely be improved upon on so small a scale as is necessarily adopted. Other striking general maps deal with geology, mineral productions, and, above all, population. The population map shows at a glance those parts of the country where people are most closely congregated, and those which are thinly inhabited or entirely unpeopled. The other maps of surface relief, mineral wealth and climate explain the reasons for the grouping of people in many cases. The chief utility of the Atlas, and this we have tested during the time when it was coming out in parts, lies in the great map of England in 67 plates on the scale of half-an-inch to a mile. Its unique feature is the system of colouring in soft and agreeable shades of green and brown to indicate the approximate height above sea level. Once this system is mastered its advantages will be too apparent to allow anyone to care for an uncontoured map again, and the system is carried out as faithfully in the little pocket "Touring Atlas of the British Isles," sold for a shilling or less, as in this great volume. The completion of this large map of England has greatly facilitated the work of identifying the sites of the rain gauges which each year sees added to the pages of *British Rainfall*, and for this we are more grateful than our readers can perhaps realise. The fine workmanship and accurate cartography of Mr. Bartholomew's publications were fitly acknowledged by the award of the *Grand Prix*—the highest distinction given—at the Universal Exposition at *St. Louis.*

Hourly Readings obtained from the Self-recording Instruments at four Observatories under the Meteorological Council, 1900. *Thirty-second Year. New Series, Vol. I.* London: Published for His Majesty's Stationery Office, 1904. Size 12 × 10. Pp. xiv. + 196. Price 25s.

THIS new series contains welcome improvements in the arrangement of the tables, greatly enhancing their utility, and more is promised. When the arrears have been overtaken it is intended to prepare the hourly readings for the press as soon as possible after the close of each month, and the sheets in the present issue are accordingly paged so that the observations for the month at the four Observatories (Valencia, Aberdeen, Falmouth and Kew) come together, but the results for the several Observatories can be grouped and bound separately if desired. The monthly observations for each Observatory are even marked "Price Sixpence," and we would suggest that while the arrears are being wiped off the separate publications of the months of 1905 be commenced up to date. When observations are already four years old we can make up our minds to wait a fifth year if by so doing the current year's record can be obtained with a minimum retardation. We should like to see a table of the hourly duration of rainfall, similar to that of sunshine, given as a supplement to the table of hourly amount of rainfall which only tells half the story; though we are happy to find that it now tells that half in an easy, straightforward manner, for it has escaped from the valley of the shadow of averages.

METEOROLOGICAL NEWS AND NOTES.

A METEOROLOGICAL STATION IN ST. JAMES'S PARK has recently been established by the Meteorological Council, near the Horse Guards Parade. It is equipped with a Halliwell self-recording rain gauge in addition to the ordinary instruments. Notice boards are also provided for the display of the records and the weather charts.

THE UTILITY OF RAINFALL OBSERVATIONS is not often so amusingly demonstrated as in the following extract from the *Daily Mail* of November 30th. One would think that with so much at stake both parties to such a contract would have been at the trouble to employ a proper instrument.

DISPUTE ABOUT A RAINFALL.—The question of rainfall at Paignton last Whit-Monday was the cause of a dispute which was decided at Totnes County Court yesterday, when the committee which arranged the Paignton gala and sports sued an insurance company for £36 15s. They effected an insurance with Lloyd's, the undertaking being that if more than ·08 in. of rain fell between nine in the morning and four o'clock in the afternoon they would receive the difference between the gate receipts and £100. The plaintiffs, who took the gauge with a pencil and an ordinary rule, measured an eighth of an inch. The defendants doubted the possibility of such a heavy fall, as at Torquay, two miles away, only a hundredth of an inch was recorded. The jury gave a verdict for the plaintiffs, and the judge said that although the committee had adopted antiquated methods, the defendants made no effort to take the gauge themselves.

RAINFALL AND TEMPERATURE, NOVEMBER, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches.	inches.	in.								
I.	London (Camden Square) ...	1·70	— ·52	·39	10	11	58·8	9	24·1	26	9	18
II.	Tenterden ...	2·04	— ·53	·95	10	11	59·0	11	25·0	26	10	14
,,	Hartley Wintney ...	1·42	— 1·06	·43	10	8	58·0	9	18·0	26, 27	14	16
III.	Hitchin ...	1·36	— 1·06	·30	7	12	58·0	9	16·0	23	13	...
,,	Winslow (Addington) ...	1·50	— ·97	·34	10	10	60·0	3	6·0	24	14	18
IV.	Bury St. Edmunds (Westley)	1·50	— 1·00	·37	23	12	59·5	3	17·0	24	...	...
,,	Brundall ...	2·00	— ·46	·52	26	15	59·0	9	23·0	24	12	17
V.	Alderbury ...	2·57	— 2·45	·29	10	6	60·0	6	17·0	27	12	...
,,	Winterborne Steepleton ...	1·80	...	·72	7	12	58·3	12	21·9	27	11	19
,,	Torquay (Cary Green) ...	1·55	...	·48	7	10	59·8	6	28·0	25	5	11
,,	Polapit Tamar [Launceston]	4·52	+ ·64	·88	10	19	58·8	14	6·9	25	13	15
,,	Bath ...	1·81	...	·48	7	8	58·2	9	21·0	24, 25	12	20
VI.	Stroud (Upfield) ...	1·52	— 1·17	·40	10	9	55·0	3	21·0	26	9	...
,,	Church Stretton (Woolstaston)	1·20	— 1·58	·30	21	11	56·5	9	24·5	23	8	...
,,	Bromsgrove (Stoke Reformatory)	·99	— ·99	·28	6	6	55·0	3, 9	6·0	23, 24	17	...
VII.	Boston ...	·57	— 1·28	·20	22	6	60·0	2	12·0	24	15	...
,,	Bawtry (Hesley Hall) ...	·80	— 1·14	·26	21	14	61·0	9	16·0	25	15	...
,,	Derby (Midland Railway) ...	1·25	— ·68	·27	10	17	56·0	9	13·0	23	12	...
VIII.	Bolton (The Park) ...	3·72	+ ·21	·85	8	16	54·6	9	21·5	24	...	...
IX.	Wetherby (Ribston Hall) ...	2·25	+ ·29	·84	7	15	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	7·04	+ ·97	3·10	8	17	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	1·51	— ·78	·38	7	18	59·0	3, 5, 9	24·0	24	8	21
X.	Newcastle (Town Moor) ...	3·14	+ ·68	·78	21	14	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	12·52	— 1·46	3·98	8	18	55·8	8	19·4	26	8	...
XI.	Cardiff (Ely) ...	3·49	— ·47	·84	6, 10	19	...	...	...	...	...	...
,,	Haverfordwest (High St.) ..	3·51	— 1·35	·78	10	17	57·2	9	21·2	27	7	18
,,	Aberystwith (Gogerddan) ..	3·18	— 1·77	·60	11	9	65·0	3	18·0	23, 26	12	...
,,	Llandudno ...	1·84	— 1·50	·40	27	15	57·0	9, 14	29·5	27	3	...
XII.	Cargen [Dumfries] ...	3·10	— 1·44	·90	22	9	57·0	3	17·0	26	13	...
XIII.	Edinburgh (Royal Observy.)	1·06	...	·38	9	13	56·4	13	24·5	26	6	15
XIV.	Colmonell ...	5·30	+ ·66	1·68	8	21	56·0	13	20·0	21	9	...
XV.	Tighnabruaich ...	5·81	...	2·30	8	21	50·0	3, 4	22·0	21	12	14
,,	Mull (Quinish) ...	4·35	— 1·62	·76	8	26	...	...	...	...	...	...
XVI.	Loch Leven Sluices ...	1·00	— 2·65	·25	9	9	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	·60	— 2·21	·15	9	13	61·5	3	21·0	26	12	...
XVII.	Braemar ...	1·39	— 2·38	·47	23	16	55·0	3	7·3	26	15	...
,,	Aberdeen (Cranford) ...	1·41	— 1·95	·67	22	13	62·0	3	15·0	25	15	...
,,	Cawdor (Budgate) ...	1·67	— 1·07	·30	9	16	...	...	...	...	...	...
XVIII.	Glencarron Lodge ...	9·12	— ·80	·96	4	29	55·1	13	15·0	21	...	...
,,	Bendamph ...	6·70	— 2·30	·57	29	29	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	2·20	— 1·09	·40	8	16	56·5	14	19·5	21	9	...
,,	Castletown ...	3·78	...	·35	7	26	56·0	17	21·0	21	11	...
XX.	Killarney ...	4·34	— 1·47	·85	7	17	60·5	6	25·0	23, 27	...	...
,,	Waterford (Brook Lodge) ...	2·15	— 1·37	·92	6	13	59·0	9	21·0	27	10	...
,,	Broadford (Hurdlestown) ...	2·51	— ·74	·63	6	17	54·0	14	25·0	21	9	...
XXI.	Carlow (Browne's Hill) ...	1·68	— 1·39	·56	6	11	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·08	— 1·48	·36	6	9	59·0	9	27·3	22	7	10
XXII.	Ballinasloe ...	2·70	— ·87	·70	6	19	61·8	13	23·0	23	10	...
,,	Clifden (Kylemore House) ..	6·22	— 1·72	1·06	7	21	...	...	...	...	...	...
XXIII.	Seaforde ...	2·36	— 1·34	·56	10	21	56·0	9	25·0	21	8	10
,,	Londonderry (Creggan Res.)	4·73	+ ·86	·58	8	25	...	...	...	...	...	...
,,	*Omagh (Edenfel)* ...	3·41	— ·30	·85	6	23	55·0	8	20·0	21	7	16

+ Shows that the fall was above the average; — that it was below it.

SUPPLEMENTARY RAINFALL, NOVEMBER, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·51	XI.	New Radnor, Ednol	2·59
,,	Sheppey, Leysdown	1·10	,,	Rhayader, Nantgwillt	4·03
,,	Hailsham	1·47	,,	Lake Vyrnwy	3·11
,,	Crowborough	1·89	,,	Ruthin, Plâs Dràw	2·17
,,	Ryde, Beldornie Tower	1·18	,,	Criccieth, Talarvor	2·76
,,	Emsworth, Redlands	1·35	,,	Anglesey, Lligwy	2·29
,,	Alton, Ashdell	1·26	,,	Douglas, Woodville	3·37
,,	Newbury, Welford Park	2·11	XII.	Stoneykirk, Ardwell House	3·65
III.	Harrow Weald	1·79	,,	Dalry, Old Garroch	6·46
,,	Oxford, Magdalen College	1·46	,,	Langholm, Drove Road	3·83
,,	Banbury, Bloxham	1·51	,,	Moniaive, Maxwelton House	3·52
,,	Pitsford, Sedgebrook	1·33	,,	Lilliesleaf, Riddell	1·86
,,	Huntingdon, Brampton	1·47	XIII.	N. Esk Reservoir [Penicuick]	2·60
,,	Wisbech, Bank House	·82	XIV.	Maybole, Knockdon Farm	3·74
IV.	Southend	·92	,,	Glasgow, Queen's Park	2·14
,,	Colchester, Lexden	1·27	XV.	Inveraray, Newtown	5·42
,,	Saffron Waldon, Newport	1·54	,,	Ballachulish, Ardsheal	6·23
,,	Rendlesham Hall	1·01	,,	Campbeltown, Redknowe	4·82
,,	Swaffham	1·60	,,	Islay, Eallabus	6·13
,,	Blakeney	1·67	XVI.	Dollar	1·67
V.	Bishop's Cannings	1·79	,,	Balquhidder, Stronvar	2·63
,,	Ashburton, Druid House	2·60	,,	Coupar Angus Station	·69
,,	Okehampton, Oaklands	4·74	,,	Blair Atholl	1·63
,,	Hartland Abbey	3·23	,,	Montrose, Sunnyside	·77
,,	Lynmouth, Rock House	3·85	XVII.	Alford, Lynturk Manse	2·03
,,	Probus, Lamellyn	2·54	,,	Keith, H.R.S.	2·39
,,	Wellington, The Avenue	2·18	XVIII.	Fearn, Lower Pitkerrie	1·79
,,	North Cadbury Rectory	1·73	,,	S. Uist, Askernish	...
VI.	Clifton, Pembroke Road	2·12	,,	Invergarry	3·77
,,	Moreton-in-Marsh, Longboro'	1·72	,,	Aviemore, Alvie Manse	1·68
,,	Rosa, The Graig	1·23	,,	Loch Ness, Drumnadrochit	2·47
,,	Shifnal, Hatton Grange	1·43	XIX.	Inversbin	2·80
,,	Wem Rectory	1·12	,,	Altnaharra	4·49
,,	Cheadle, The Heath House	1·80	,,	Bettyhill	4·23
,,	Coventry, Kingswood	1·59	,,	Watten, H.R.S.	2·20
VII.	Market Overton	1·16	XX.	Cork, Wellesley Terrace	1·65
,,	Market Rasen	1·07	,,	Darrynane Abbey	4·57
,,	Worksop, Hodsock Priory	·98	,,	Glenam [Clonmel]	2·23
VIII.	Neston, Hinderton	1·78	,,	Ballingarry, Hazelfort	2·29
,,	Southport, Hesketh Park	2·04	,,	Miltown Malbay	3·45
,,	Chatburn, Middlewood	5·09	XXI.	Gorey, Courtown House	1·35
,,	Duddon Valley, Seathwaite Vic.	6·89	,,	Moynalty, Westland	2·12
IX.	Langsett Moor, Up. Midhope	4·26	,,	Athlone, Twyford	3·53
,,	Baldersby	1·97	,,	Mullingar, Belvedere	1·99
,,	Scalby, Silverdale	2·87	XXII.	Woodlawn	3·54
,,	Ingleby Greenhow	2·55	,,	Westport, Murrisk Abbey	4·07
,,	Middleton, Mickleton	2·92	,,	Crossmolina, Enniscoe	5·55
X.	Beltingham	3·74	,,	Collooney, Markree Obsy	5·39
,,	Bamburgh	2·62	XXIII.	Enniskillen, Portora	3·24
,,	Keswick, The Bank	4·18	,,	Warrenpoint	1·39
,,	Melmerby Rectory	3·88	,,	Banbridge, Milltown	2·04
XI.	Llanfrechfa Grange	2·31	,,	Belfast, Springfield	2·87
,,	Treherbert, Tyn-y-waun	5·85	,,	Bushmills, Dundarave	5·08
,,	Llandovery, Tonn	...	,,	Stewartstown	3·15
,,	Castle Malgwyn	3·51	,,	Killybegs	5·73
,,	Llandefaelog-fach	3·37	,,	Horn Head	5·80

METEOROLOGICAL NOTES ON NOVEMBER, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm. R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Fair and sunny from 2nd to 4th, followed by a week of rough and wet weather during which almost the whole of the month's R fell. From 13th to 18th dense morning fogs prevailed, with high bar. and remarkably little air movement. Wintry conditions set in on 21st and continued till 28th with S on 22nd and 23rd. Duration of sunshine 35·0* hours and of R 39·1 hours. Mean temp. 42°·0, or 1°·0 below the average.

TENTERDEN.—Wet from 6th to 10th. Sunny from 12th to 15th and on 23rd and 26th. Fog all day on 18th. Frost from 21st to 29th. Duration of sunshine 85·5† hours.

HARTLEY WINTNEY.—The beautiful summer lingered on in mild and calm weather until the 21st, when a sharp snap of winter supervened with extreme cold until the end. Fog from 12th to 20th. Ozone on 16 days, mean 3·8.

HITCHIN.—Very dry and the coldest November since 1858.

TORQUAY, CARY GREEN.—R 2·18 in. below the average. Mean temp. 46°·4, or 1°·1 below the average. Duration of sunshine 96·9* hours, or 31·5 hours above the average. Mean amount of ozone 3·5.

CLIFTON.—Dull and dry till 5th, with N.E. winds and high bar. Then very wet till 10th, with westerly winds, reaching a gale on 8th and 9th. After heavy R on 21st severe frost set in suddenly and lasted till 28th, with fog on several days and about an inch of S on 23rd. R 1·30 in. below the average.

WORKSOP, HODSOCK PRIORY.—Sharp spell of frost from 21st to 29th was only equalled in November by that of 1890.

BOLTON.—Mild until 20th, but on 21st the wind shifted to N. and the temp. fell rapidly till 24th. Milder weather again on 29th. There was much fog, and during the latter part several falls of S occurred. Duration of sunshine 21·8* hours, or 3·8 hours below the average.

SOUTHPORT.—The ninth consecutive month with a deficiency of R. Mild generally until 20th and on 29th and 30th, but very cold during the intervening period. Duration of sunshine 3* hours below the average, and R 1·22 in. below the average. Underground water level unprecedentedly low for November.

LLANFRECHFA GRANGE.—Sharp frost from 21st to 29th and S on 23rd; otherwise mild with a good deal of fog.

SCOTLAND.

LANGHOLM.—R 1·50 in. below the average of 28 years. S fell heavily all day on 21st, amounting to 13 inches. Roads and railways were blocked and many sheep were lost in the hill districts by drifting.

COLMONELL.—On the 9th occurred the greatest flood for at least 15 years. On 21st 3 inches of S fell, the heaviest in 28 years' records. Mean temp. 43°·3 or 1°·6 above the average of 28 years.

MULL, QUINISH.—Singularly mild and calm, except from 20th to 24th, when there were N. winds and S showers.

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* Campbell-Stokes. † Jordan.

COUPAR ANGUS.—The cold snap commencing on 21st was the most severe since November, 1885. Mean temp. of the month 37°·8, or about 2° below the average. The mean temp. of the last 11 days was 14° lower than that of the first 19.

DRUMNADROCHIT.—About a foot of S between 19th and 27th, but no excessive frost and no drifting.

IRELAND.

CORK.—R 2·41 below the average. Mean temp. 1°·8 below the average, that of the first 19 days being 48° and of the last 11 days 36°. Rather heavy S on 21st. Fog till 20th, but not dense.

DUBLIN.—Very open and generally fine until 19th, when a sudden change to wintry conditions began. Cold and frosty from 20th to 28th inclusive, then mild. S or sleet on 4 days. Fog on 7 days.

MARKREE OBSERVATORY.—On 21st S and H set in for 3 days, followed by heavy R on 26th.

OMAGH.—Damp and extremely mild until 20th, when a sudden change to squally polar winds was accompanied by the heaviest S since February, 1895, and the lowest temp. in November since 1878. This abnormal weather continued till 27th, but so heavy was the S that it required the mild temp. of many following days to reveal the grass again.

*** *Additional information as to the weather of November will be found in the article on p.* 201.

THE ELEVEN MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—November, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	18·87	91	Arncliffe	51·73	94	Braemar	23·13	73
Tenterden	21·66	90	Hull	19·82	86	Aberdeen	23·33	81
Hartley Wintney	21·49	94	Newcastle	21·49	92	Cawdor	20·42	74
Hitchin	19·53	92	Seathwaite	114·95	96	Glencarron	78·82	94
Winslow	20·48	94	Cardiff	39·88	113	Dunrobin	25·11	91
Westley	18·89	81	Haverfordwest	37·82	98	Killarney	46·11	94
Brundall	18·95	83	Gogerddan	40·06	100	Waterford	37·36	108
Alderbury	24·24	98	Llandudno	22·97	83	Broadford	35·38	118
Ashburton	45·55	104	Dumfries	35·44	90	Carlow	29·97	99
Polapit Tamar	39·60	120	Lilliesleaf	25·57	93	Dublin	20·69	83
Stroud	24·64	100	Colmonell	39·50	101	Mullingar	31·67	96
Woolstaston	24·13	91	Glasgow	31·24	96	Ballinasloe	35·79	108
Boston	18·37	98	Inveraray	62·73	98	Clifden	73·63	103
Hesley Hall	18·18	94	Islay	47·53	115	Crossmolina	54·90	118
Derby	18·52	89	Mull	53·37	107	Seaforde	31·51	96
Bolton	31·45	84	Loch Leven	29·80	93	Londonderry	38·68	104
Wetherby	24·04	110	Dundee	22·90	93	Omagh	40·04	112

Climatological Table for the British Empire, June, 1904.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	76·7	30	43·1	4	70·1	49·4	50·2	78	126·1	38·3	·84	6	6·2
Malta	95·2	28	61·4	1, 3	83·4	67·6	64·9	72	143·6	56·3	·16	3	3·0
Cape Town	69·5	19	40·7	24	61·4	48·7	48·3	73	...	...	6·55	17	6·6
Durban, Natal	90·0	24	48·8	28	76·1	54·5	...	...	137·2	...	·66	5	2·3
Johannesburg	65·7	6	32·5	11	59·6	42·3	34·4	59	...	...	·31	4	1·1
Mauritius	76·6	27	54·5	30	75·3	60·9	59·8	76	133·7	46·3	3·56	17	5·1
Calcutta	101·2	6	74·2	14	90·4	78·7	77·8	84	157·0	73·0	10·25	19	7·7
Bombay	92·6	7	74·6	16	87·5	79·7	77·2	82	138·5	73·8	15·10	25	7·1
Madras	103·5	3	79·1	28	99·8	82·0	68·4	55	156·5	76·3	·61	10	6·9
Kodaikanal	66·2	11	50·6	11	61·3	52·8	51·1	84	133·6	46·0	2·60	22	8·3
Colombo, Ceylon	86·4	9	72·2	19	84·5	76·4	70·0	79	154·5	70·0	9·51	24	8·0
Hongkong	91·1	26	72·2	1	85·0	76·0	74·1	83	141·5	...	19·64	17	7·2
Melbourne	64·9	21	32·9	...	64·0	33·6	44·3	81	120·1	26·8	3·29	18	7·7
Adelaide	66·0	10	41·7	4	59·2	47·1	45·2	77	120·7	34·2	3·92	19	7·6
Coolgardie	72·1	8	35·7	28	60·7	44·8	44·0	72	140·2	32·1	1·40	12	6·4
Sydney	69·6	21	39·5	20	59·0	44·4	40·1	77	93·8	29·1	·19	11	2·2
Wellington	63·7	15	37·9	9	53·8	43·4	40·7	73	98·0	33·0	6·96	20	5·8
Auckland	62·0	2	38·0	30	57·2	47·9	46·2	79	115·0	34·0	6·07	24	6·5
Jamaica, Negril Point	88·1	1	69·9	9	85·5	75·6	73·1	79	...	...	16·07	9	8·2
Trinidad	88·0	2*a*	67·0	*b*	86·1	69·5	72·1	79	161·0	63·0	6·23	14	...
Grenada	84·2	29	68·4	7	82·2	73·4	70·7	78	142·0	...	7·31	23	5·0
Toronto	82·9	25	44·1	23	72·1	53·6	55·1	76	112·0	37·0	2·77	13	5·7
Fredericton	83·1	24	35·0	12	71·0	46·9	45·9	54	...	...	2·05	7	4·9
Winnipeg	89·0	18	37·5	6	71·7	50·5	...	...	...	...	4·22	11	6·1
Victoria, B.C.	79·0	29	43·2	11	63·2	48·9	...	...	...	...	1·36	5	4·7
Dawson	74·6	3	33·0	16	66·2	42·9	...	...	...	...	1·71	7	4·5

a and 16, 23, 29. *b* several days.

MALTA.—Mean temp. of air 74°·4 or 2°·9 above the average. Mean hourly velocity of wind 8·0 miles, or 0·8 below average. Mean temp. of sea 71°·1.

Mauritius.—Mean temp. of air 1°·0, dew point 1°·3 below, and R 1·51 in. above averages. Mean hourly velocity of wind 9·4 miles, or 1·8 miles below average.

MADRAS.—Bright sunshine 117·8 hours.

KODAIKANAL.—Bright sunshine 68 hours.

COLOMBO.—Mean temp. of air 79°·8, or 1°·3 below, of dew point 4°·1 below, R 1·27 in. above, averages. Mean hourly velocity of wind 11·7 miles.

HONGKONG.—Mean temp. of air 79°·8. Sunshine 162·1 hours. Mean hourly velocity of wind 9·9 miles.

Sydney.—Mean temp. of air 2°·7 below, and R 5·30 in. below, averages.

Wellington.—Mean temp. of air 2°·5 above, and R 1·98 in. above, averages.

Auckland.—R 1·75 in. above average of 34 years.

TRINIDAD.—R 2·09 in. below the 40 years average.

Symons's
Meteorological Magazine.

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THE RAINFALL OF 1904.

THE aggregate table of rainfall, given on the penultimate page of the volume, takes the shape this month of a summary of the rainfall for the year. The ratios in the second column of figures refer to the ten years' average, 1890–99; but for the sake of a wider comparison, we refer in the text of this article to the more satisfactory average of the thirty years, 1870–99, which we hope to use exclusively in our next volume. The following discussion formed part of a letter to *The Times*, published on January 10th.

The Table may be studied in various lights, but it does not appear sensational in any. We may look at it, first, according to actual amounts. The area with a rainfall exceeding 40 inches was but little smaller than in an average year, and the wettest places in Cornwall, Devon, Wales and the west of Scotland, seem to have had nearly their average fall. The area with rainfall under 30 inches was, however, very much larger than in an average year, the whole eastern prominence of Scotland, from the Highland railway to Aberdeen and Peterhead—all of which, except the coastal fringe, has usually more than 30 inches—had less than that amount last year; and the whole of England below the level of about 600 feet, seems also to have had less than 30 inches. The lowest rainfall, that under 20 inches, was found in southern and eastern Essex, and in the counties of Suffolk, Cambridge, Huntingdon, Northampton, and Nottingham. The extremes of rainfall noted were 129·33 at Seathwaite, and 16·09 at Shoeburyness.

We may next consider the Table with relation to the average. The distribution of variation from the average was interesting, and may be expressed by saying that the whole Atlantic border of the British Isles, from Cornwall through the west of Ireland and the west of Scotland to Shetland, had more than the average amount of rain, while the continental aspect of the country had less than the average amount. The excess was most marked in the west of Ireland, the greatest that appears being 18 per cent. at Crossmolina, but the east of Ireland was so dry that the whole island exceeds the average by just 1 per cent. The wet western fringe of Scotland

included the Hebrides and the extreme west coast, though it seems to have spread across the Lowland Valley to the Firth of Forth. For the whole of Scotland, so far as we can judge in the absence of several old Highland records recently allowed to lapse, the year showed a deficiency of 8 per cent. This was due mainly to the exceptional dryness of the east coast, especially in the great triangle cut off by a line drawn from Dundee to Inverness. Braemar appears to have been relatively the driest point in the British Isles, the amount recorded for 1904 showing a deficiency of 31 per cent. from the average.

In England and Wales only a few coast stations, chiefly on the Bristol Channel and in Cornwall, and some on the South Downs, showed an appreciable excess of rainfall; as a whole there was a deficiency of 12 per cent. The driest region occupied the Midlands and extended to the Severn on the south-west, the Humber on the north-east, and Yarmouth on the east. The whole of this area had a deficiency exceeding 20 per cent., and at Wisbech it was as great as 29 per cent. The north of Norfolk and the whole of Lincolnshire seem to have escaped the drought.

Taking the British Isles together, the deficiency of rainfall in 1904 does not seem to have exceeded 8 per cent., so that it may be classed as a moderately dry year, though not quite so dry as 1902, to which dull, ungenial weather gave a bad, but undeserved, name for raininess.

WEATHER INFLUENCES—A REVIEW.

PROFESSOR E. G. DEXTER, who occupies the chair of Education in the University of Illinois, has written a very important book* on the influence of weather on human life and conduct. We are accustomed to think and speak, in a general way, of the weather as affecting not only our physical comfort, but the state of our nerves as well. Such words as "relaxing" and "bracing," applied to climates, cover vaguely a mass of semi-instinctive and wholly indefinite knowledge in which we all believe, though few of us could give any scientific grounds for our belief. Dr. Dexter has made a bold attempt to investigate the influence of weather on human feelings and faculties by exact statistical methods, and he has reached certain conclusions, so definite and so well established by evidence as to command complete confidence for the places and in the climates which he has studied. There is no subject more attractive to the mentally active, but untrained in science, than weather, its effects and its causes. One opens a new book on these matters with trepidation, fearing that it may prove another instance of pathetic

* "Weather Influences, an empirical study of the mental and physiological effects of definite meteorological conditions." By Edwin Grant Dexter, Ph.D., with introduction by Cleveland Abbe, LL.D. New York: The Macmillan Company; London: Macmillan & Co. 1904. Price 8/6, net.

delusion, or cunning charlatanism, and great was the relief on this occasion when chapter after chapter showed that Dr. Dexter, although not professing any special knowledge of meteorology, was a master of scientific method, and a living example of scientific caution.

In the introduction, Professor Cleveland Abbe gives a valuable summary of the earlier literature of the subject, and deals with the question of the direct and indirect influence of climate on mankind, a larger question than that attacked by Dr. Dexter, who carefully limits his study to the effects of weather. Incidentally, however, he touches on climate, and in so doing he makes a somewhat serious blunder. Speaking of the effect of temperature, he asserts that north of 55° N., the vital energy is so much drawn upon to counteract the low temperature, that there is little left for those activities which make leaders. We venture to think that the history of Scotland, of Norway, of Sweden, and of Iceland, refutes this rather random rule.

The first four chapters deal pleasantly and freshly with such familiar themes as weather lore, proverbs, and weather influences, in literature. Then comes a statement of the empirical problem to the solution of which the author set himself. He states it thus:—

"For any given community of limited area, a change in weather conditions means a change in the environment for every inhabitant. If this change in the environment tends to influence conduct, and any statistics of conduct are kept, their study in connection with the records of the weather would disclose the fact. It is just this problem with which our study deals. It is an attempt, by empirical methods, to discover the influence of the weather upon human behaviour. It has nothing to do with the permanent or racial effect of prevailing meteorological conditions, but with the immediate and temporary effect of definite fluctuations of these conditions. In other words—not of climate, but of weather."

Two cities were selected for this detailed study: New York, at sea-level on the Atlantic coast, and Denver, in Colorado, on a plateau 5,200 feet above the sea, in the heart of the continent. Statistics of conduct, or, as it is termed in America, deportment, were obtained from certain prisons and schools, and of crimes from police courts and newspapers, the total number of cases tabulated being very large indeed, and occurring during ten years.

"In the tabulation the average daily occurrence for all the days falling under a given meteorological condition, was compared with the average daily occurrences for the whole period studied, and an excess or deficiency was ascribed to weather influences. The right to do this might at first thought be questioned, but . . . . There is, in fact, but one condition in the environment which changes simultaneously for all the individuals considered, and that is the weather."

It is not suggested that the weather influences moral conduct directly, but that in certain conditions of weather a state of mind is produced in which the power of resistance to temptations, which

in themselves have nothing to do with atmospheric conditions, is weakened or strengthened. The method employed was limited to an investigation of mean barometer, temperature, humidity, total wind movement, character of the day, and precipitation. These data were got out for every day of all the years under investigation. The days were then separately classified for certain small ranges of each of the meteorological conditions, and a curve of expectancy was prepared by which to judge the accordance of the deportment statistics. Thus if 1 per cent. of all the days considered had a range of temperature between 30° and 35°, and 10 per cent. had a range between 70° and 75°, it would be expected that if suicide had no relation to temperature, the total number of suicides during the latter period would be ten times as great as during the former. However, in drawing the curves, all the values are reduced to the excess or deficiency of the daily averages for the period in question, with respect to the expectancy curve, so as to obviate the confusion likely to arise from the mere magnitude of the number.

A series of chapters deals in succession with the influence of the weather on the conduct of children in school, on various forms of crime, on insanity, on health, on suicide, on drunkenness, and on attention, each one illustrated by a series of curves, one for each of the meteorological conditions examined. A general chapter summarizes all the foregoing, and from it rather than from the detailed discussion we draw the following conclusions.

So far as the seasonal occurrence of the conditions studied is concerned, it appears that in the cold months sickness, death, and drunkenness are far more frequent than in the warm months; whereas crime and suicide are most developed in the summer. The effects of temperature (without regard to season) are shown much more distinctly in the case of females than of males, especially in the increase of pugnacity and of "mental unbalancing" in hot weather.

Contrary to one's expectation, the influence of barometric pressure was found to be more distinct than that of any other meteorological condition. A low barometer is characterized by increase in crime, insanity and bad conduct; sickness and suicide also seem to be increased, while drunkenness is diminished, and attention, as tested by the number of clerical errors made by bank clerks, is either more perfect, or special precautions are taken to guard against errors.

Humidity may be dismissed with the remark that a dry atmosphere is a stimulant to all forms of active disorder and to suicide, but is an enemy to intoxication and mental inexactness.

With regard to wind, the most remarkable results ascertained are that calms produce an excessive development of those life phenomena which are due to depleted vitality. Thus crime, insanity and bad conduct in school and prison, drop to a very small frequency, in the case of females especially, while sickness, death, and want of attention, are above the average, and there is a tremendous increase in

the number of absences from school. These facts are explained by the statistics being compiled from large cities, where an absence of wind means stagnation of the atmosphere and the accumulation of carbonic acid and other deleterious constituents. Fogs are not treated specially, but they no doubt assist in intensifying the depressing effects of calms. The diminution in crime and misconduct are due obviously to lack of strength or spirit, not to any tendency to a higher morality in calm weather.

In conclusion, we present Dr. Dexter's final epitome in his own words, some of which will require a careful study of his volume to explain fully, but we feel considerable confidence in accepting the various propositions, after reading the ample proofs presented in his pages.

I.—Varying meteorological conditions affect directly, though in different ways, the metabolism of life. II.—The "reserve energy" capable of being utilized for intellectual processes and activities, other than those of the vital organs, is affected most by meteorological changes. III.—The quality of the emotional state is plainly influenced by the weather states. IV.—Although meteorological conditions affect the emotional states, which without doubt have weight in the determination of conduct in its broadest sense, it would seem that their effects upon that portion of the reserve energy which is available for action are of the greatest importance.

The outcome of the whole study is, that crimes of violence and bad conduct in school or in prison are due to excessive vitality imperfectly controlled, and their frequency is increased by whatever conditions of weather increase vitality; while illness, insanity, and death, result from deficient vitality, and work greater havoc when depressing atmospheric conditions prevail.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, December 21st, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

An interesting discussion took place on Mr. F. J. Brodie's paper on the "Decrease of Fog in London during recent years," which was read at the previous meeting. [For a summary of this paper, *see* p. 213]. By an apt coincidence, a remarkably dense fog prevailed throughout the day, and so added special emphasis to the occasion.

The President was of opinion that fogs were due to meteorological effects. The presence of dust in the atmosphere was often invoked to explain the formation of fog, but he did not think that was correct, as at sea, where there could not be much dust, fogs were quite as dense as London fogs, only cleaner.

Mr. W. Marriott thought that Mr. Brodie should have clearly

stated what he meant by the term fog, as by speaking about "town fog" one was almost led to suppose that he had dealt only with what was popularly called "London fogs," and not fogs in the ordinary or meteorological acceptance of the term. The International Meteorological Congress of Vienna had adopted the same symbol for both fog and mist, which they evidently believed to be phases of the same phenomenon. Mr. Marriott exhibited some lantern slides, showing by symbols the meteorological phenomena observed at the stations of the Royal Meteorological Society, as printed some years ago in the *Meteorological Record*, and pointed out how his own observations of fog at West Norwood were confirmed by those of Mr. Mawley at Addiscombe. These gave a greater number of days of fog than were recorded in Mr. Brodie's paper for Brixton. Mr. Marriott believed that there was a considerable connection between fogs and the absence of wind. He showed lantern slides on which were given curves of the number of occasions on which the velocity of the wind at the Royal Observatory, Greenwich, was less than 200 miles per day. These curves corresponded in a very remarkable manner with those of the days of fog at West Norwood.

Mr. J. E. Clark described the means which he had employed at his office at Finsbury Square, E.C., for measuring the amount of darkness in the daytime by noting the number of quarters of an hour that it was necessary to resort to artificial light. [*See* this Magazine, **36**, p. 94].

Dr. W. N. Shaw thought that Mr. Marriott's suggestion that fog was most prevalent when there was an absence of wind was probably correct. This was confirmed by the inquiry on "London fogs" taken in hand by the Meteorological Office for the London County Council, as one of the difficulties of the second winter's work was the marked decrease of fog owing to the increase of wind.

Mr. C. Harding was of opinion that wind was a very important factor in connection with the matter under discussion, and referred to the instances in which fog was prevalent when the velocity of the wind at the Royal Observatory, Greenwich, was less than 100 miles per day.

Dr. H. R. Mill said that he had compared Mr. Brodie's figures with those of the number of rainy days and the amount of rain at Camden Square; and found that very often a year which had frequent fogs had few rainy days or little rain, while a year with few fogs had many rainy days or much rain. This relationship is not surprising, for if the years in which fogs are frequent are those in which anticyclonic conditions have been predominant or at least unusually common, they should be dry years as well; while years of frequent cyclonic disturbances ought to be wet and free from fogs.

Captain W. F. Caborne spoke on the work of the Coal Smoke Abatement Society; and letters were read from Mr. A. A. Pearson and the Hon. F. A. Rollo Russell, referring to the influence in

reducing fogs of the increasing number of paved streets and of slate roofs in London.

Mr. F. J. Brodie, in reply, said that he thought it would be found that dust was present in even sea fogs, although not to the same extent as on land. He had used the Brixton figures in his paper because they were the official figures. He thought the connection between fog and absence of wind must be patent to everybody, and that there could not be a London fog when a wind of force 3 or more was blowing.

A paper by Dr. W. N. Shaw, F.R.S., and Mr. W. H. Dines, was also read. The authors described an apparatus called the "Micro-Barograph," which they have designed to magnify the minor fluctuations and at the same time to disentangle them from the general barometric surges. They also showed some interesting records from three of these instruments—two being at South Kensington and the other at Oxshott. The authors wish to obtain information as to the nature of the disturbances and the causes to which they may be assigned. Among the causes which suggest themselves as likely to produce temporary fluctuations of the barometric curves are—(1) Atmospheric billows passing along surfaces where there is discontinuity of density in a manner somewhat similar to ocean waves: (2) the passage of minute whirls, or cyclonic depressions of small dimensions; (3) variations of pressure due to the attraction or repulsion produced by electric stress as masses of air at different potential pass by; (4) the mechanical effects of wind; and (5) the mechanical effects of the rapid condensation of aqueous vapour.

The following gentlemen were elected Fellows of the Society:—Mr. W. H. Chambers Bullen, Dr. H. A. Des Vœux, Mr. R. G. K. Lempfert, M.A., and Mr. R. M. MacFarlaine.

SCOTTISH METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on December 6th at 4 p.m., in the rooms of the Royal Society of Edinburgh, the Hon. Lord M'Laren in the chair.

Dr. W. N. Shaw, F.R.S., communicated an important paper on "The Treatment of Climatological Observations." The practice of summarising observations in the form of weekly and monthly means and extremes was convenient, and the results for some purposes valuable, but since the actual weather of the British Isles does not arrange itself in such regular periods, a system of classification which dealt with consecutive weekly or monthly divisions as homogeneous left something to be desired for certain problems. The distribution of barometric pressure from day to day might be adopted usefully as a basis of classification, and the object of the inquiry, towards which the paper was a first contribution, was threefold:—

First, to combine the climatological data in such a way as to exhibit effectively the modifying influence of geographical position upon the general weather conditions of the locality. Second, to mark out in clear outline and give numerical expression to the specific characteristics of weather associated with distributions of pressure which may be regarded as typical. Third, to secure the co-operation of the observers at the normal climatological stations in filling in the outline by putting together the data for their stations, as they are obtained, upon some plan organized by mutual agreement.

Six different types of isobaric distribution might be distinguished :—

I. S.E. Type.—A pressure distribution favourable for S.E. winds, or, according to the amount of incurvature, for E. winds.
II. S.W. Type.—For winds from S.W., or from some point nearer S.
III. N.W. Type.— „ „ „ N.W., „ „ „ „ „ W.
IV. N.E. Type.— „ „ „ N.E., „ „ „ „ „ N.
V. Variable Cyclonic Type, with the sequence of winds incidental to the passage of a cyclonic depression.
VI. Variable Anticyclonic Type, with the uncertain winds of the interior of an anticyclonic region.

This was, of course, not an exhaustive classification ; indeed, each of the first four types might be conveniently subdivided into three, according as any station was in a position where the isobars were concave towards the low pressure area, nearly straight, or concave towards the barometric maximum.

So far the inquiry had extended to groups of stations in the districts named and for the periods indicated in the following table, which gives the number of days in the different periods that might be referred to the several types :—

TYPE.	England N.W. 1896-1898.		Midland Counties. 1897-1899.		Scotland E. 1897-1899.
	January.	July.	January.	July.	January.
I. S.E.	13	2	11	7	11
II. S.W.	40	35	32	19	43
III. N.W.	18	28	12	27	18
IV. N.E.	13	6	14	13	5
V. Variable Cyclonic	7	8	5	6	5
VI. Variable Anticyclonic	2	14	19	21	11

The data for the first two districts were for periods with only two years in common, but the January data for Scotland E. and for the Midland Counties of England for one and the same period showed a relative preponderance of the S.W. and N.W. types in the more northern district and represented definitely a difference of climatic conditions for the two districts.

The weather of each station in each group had been analysed as regards rainfall, temperature, &c., and the results gave a definite

measure of the peculiarities of any place or district for any type of weather. Thus in July, both in England N.W. and in the Midland Counties, the dryness of the N.W. and N.E. types was well marked, as also the irregularities of the distribution of rainfall with the variable cyclonic type of weather. Again, in Scotland E. in January there were high temperatures with the N.W. type and low temperatures with the S.W. type, a marked absence of sunshine with the S.E. type, and irregular rainfall with the N.E. type.

Altogether, the method of distributing the observations according to weather types brought out a number of striking points which would be masked or obliterated if only weekly or monthly averages were used. The student of meteorology would be able to get :—

A much clearer and more definite insight into the facts of meteorology by bringing to the numerical test a number of statements which have long been recognised in a more vague and general form.

Such work was necessarily laborious, but might be lightened by the co-operation of observers in the various districts.

The paper was fully illustrated by diagrams and lantern slides.

A short paper on "The Vertical Gradient of Rainfall," by Mr. A. Watt, M.A., was also communicated. The 19 years' series of rainfall records from the Ben Nevis Observatories showed, somewhat unexpectedly, that the ratio of the amount of rainfall at the top of the mountain to that at the foot exhibited very little variation from month to month. On the other hand, comparing the rainfall on the Puy-de-Dôme with that at its base station, Clermont, for an 18 years' period, we had a radically different curve, the two sets of monthly ratios being as follows :—

	J.	F.	M.	A.	M.	Ju.	Jy.	A.	S.	O.	N.	D.
Ben Nevis, Fort William	1·9	1·9	2·3	2·2	2·3	2·2	2·3	2·2	2·1	2·0	2·0	1·9
Puy-de-Dôme, Clermont	5·5	4·5	4·2	2·8	1·8	1·6	1·7	1·8	1·8	2·3	2·9	4·6

The two Scottish stations had much heavier rainfalls than the two French ones, and only the general character and not the amplitude of the two curves was in consideration, especially since differences of height might affect the problem. The speculation was indulged in that the difference of the curves could be accounted for on the following suppositions :—(1). That the greater part of the Ben Nevis rainfall was of cyclonic origin, since there did not seem any theoretical reason why the gradient of rainfall of purely cyclonic origin in a mountainous district should have a seasonal variation ; (2). That a great part of the Central France rainfall was of local convectional origin. The zone of maximum rainfall of such origin varied greatly in height with the seasons—as explained by Hann and others—and would certainly be in summer far above the level of the Puy-de-Dôme, and in winter probably below that level. But all rainfall problems were complex, especially those dealing with high-levels, since the mass of a mountain had a double influence—in deflecting winds upwards and in setting up or assisting local convectional currents in warm weather.

CLIMATE OF THE BRITISH EMPIRE IN 1903.

THE completion of the climatological records of the British Empire for 1903 enables us once more, and for the twenty-second time, to summarise the observations for a year. It is gratifying to notice that out of the sixteen stations which appeared in the table for 1882 no fewer than thirteen are among the twenty-five for which it is possible to give more or less complete records for 1903. It is, however, still obviously impossible to represent the average conditions of the climate of the Empire by so small a number of stations, however well distributed; but the records do display the diversity of the many climates of our scattered dominions.

Adelaide, which has almost constantly held the first place in the summary for extreme maximum temperature, is, as in 1902, naturally outshone by Coolgardie, in Western Australia, which comes to the front with the notable shade temperature of 113°·4, the second highest reading we have ever had occasion to quote. It must be remembered, however, that we do not publish returns from any of the intensely hot stations in the north-west of India. The minimum temperatures at Dawson are unprecedented in these tables, as this station has only been at work for a few years, and the winter returns have frequently been imperfect.

It is of interest in connection with the extremely wet character of 1903 over the greater part of the British Isles to note that the rainfall of London was the highest ever recorded there. The rainfall elsewhere showed no tendency to be exceptional, and more stations had a deficiency than an excess.

The range of shade temperature in the British Empire in 1903 was 174·2 Fahrenheit degrees, between the Coolgardie maximum and the Dawson minimum; and it is a tribute to the power of gold in attracting population to uncomfortable places that thousands of miners brave the torrid heat of the Coolgardie summer, and the more than polar cold of the Dawson winter.

SUMMARY.

Highest Temp. in Shade	113°·4 at Coolgardie, on Jan. 27th.
Lowest „ „	—60°·8 at Dawson, on Jan. 26th.
Greatest Range in year	150°·3 at Dawson.
Least „ „	22°·8 at Grenada.
Greatest Mean Daily Range ...	23°·5 at Winnipeg.
Least „ „ „ ...	8°·5 at Hong-Kong.
Highest Mean Temp. in Shade...	82°·3 at Madras.
Lowest „ „ „ ...	22°·8 at Dawson.
Highest Relative Humidity ...	82% at London.
Lowest „ „ ...	62% at Adelaide.
Highest Temp. in Sun.....	177°·0 at Trinidad, on Nov. 14th.
Greatest Rainfall.....	93·67 in. at Hong-Kong.
Least „	10·74 in. at Dawson.
Most Cloud	6·8 at Hong-Kong.
Least „	3·3 at Grenada.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1903.

Stations. *Those in Italics are South of the Equator.*	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Mean.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Rainfall. Depth.	Days.	Average. Cloud.
	°		°		°	°	°	°	%	°	°	in.		0—10
London	87·2	July 10	22·1	January 16	58·2	44·0	51·1	45·5	82	133·7	17·3	38·10	179	6·1
Malta	100·3	Sept. 13	42·5	Feb. 4, 19	71·5	58·2	64·8	56·3	78	148·7	37·1	15·87	63	3·5
Lagos	93·0	March 8	68·0	Jan. 1, Sep. 28	86·2	75·6	80·9	...	...	148·0	...	68·85	108	...
Cape Town	92·1	February 11	37·7	July 1, 25	68·5	53·7	61·0	51·5	73	...	...	29·93	120	4·6
Durban	96·1	Sept. 29	46·1	June 27	79·2	61·3	70·2	...	...	152·3	...	35·66	145	4·5
Mauritius	89·0	January 10	55·1	July 13	80·8	67·0	73·9	65·4	75	160·0	45·3	41·75	209	5·9
Calcutta	107·6	April 29	48·9	January 1	87·8	70·7	79·3	68·4	72	164·0	41·9	54·14	79	4·6
Bombay	93·7	May 22	56·0	December 27	85·5	74·1	79·8	71·1	76	140·7	48·9	84·49	111	3·8
Madras	103·1	June 27	65·3	December 8	89·7	74·9	82·3	72·6	79	147·1	60·5	79·62	104	4·6
Kodaikanal	74·5	March 23	42·7	December 14	64·7	51·4	58·1	48·4	76	152·1	28·7	69·55	120	5·8
Colombo	94·0	March 14	68·5	February 1, 3	87·0	75·9	81·5	73·8	81	155·8	62·2	78·09	182	5·8
Hong-Kong	92·4	July 31	41·9	February 3	76·3	67·8	72·0	63·8	77	147·5	...	93·67	135	6·8
Melbourne	105·0	January 31	28·4	June 11	66·9	49·8	58·3	47·6	72	165·3	20·5	28·43	130	6·4
Adelaide	105·6	February 9	32·2	July 11	71·1	52·8	61·9	47·9	62	161·9	27·5	25·47	134	...
Coolgardie[1]	(113·4)	(January 27)	34·4	August 3	...	...	...	...	...	(173·6)	27·3	...	...	...
Sydney	98·1	February 3	38·4	June 26	69·2	56·7	63·0	50·4	73	139·5	29·8	38·62	197	5·4
Wellington	79·5	November 30	31·0	August 2	61·2	48·5	54·8	46·2	74	138·0	21·0	53·80	179	6·2
Auckland	78·0	February 15	34·0	July 16	63·9	53·2	58·6	49·4	72	150·0	32·0	45·13	194	5·3
Jamaica	92·1	August 10	61·0	November 30	86·3	72·0	79·1	70·8	76	...	...	42·84	105	...
Trinidad	96·0	June 1	56·0	Sept. 30	87·0	69·2	78·1	71·4	78	177·0	60·0	51·64	...	...
Grenada	92·4	April 30	69·6	March 13	84·5	74·2	79·4	70·6	74	157·2	...	78·89	232	3·3
Toronto	91·5	July 8	— 9·7	December 28	54·4	37·7	46·0	39·1	76	110·7	—13·5	30·64	...	6·1
Winnipeg	93·8	July 23	—36·7	February 15	46·8	23·3	35·1	...	...	...	...	16·92	95	4·9
Victoria, B.C.	87·8	June 8	26·4	March 12	54·8	43·9	49·3	...	...	...	...	26·27	...	6·7
Dawson	89·5	June 19	—60·8	January 26	32·3	13·4	22·8	...	...	...	...	10·74	59	4·0

[1] December wanting.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

FOG IN LONDON.

THIS morning at 9 a.m. I measured ·04 in. of "rain," consisting of condensed fog for previous 24 hours. I have never measured so much before, and think it worthy of note.

As to fogs being less prevalent in the London district during the last 10 years, as described in your report of the recent meeting of the Royal Meteorological Society, is not that probably due to the mild cyclonic type of the last 9 out of 10 winters?

STANLEY SINGLE.

Park View, Leopold Road, Wimbledon, Dec. 20th, 1904.

WITH regard to the dispersal of fogs, it has often occurred to me that by creating a wind or breeze from different portions of the City and suburbs, fogs might be dispersed or perhaps mitigated.

My idea is to have large shallow tanks, or long narrow troughs, in various open spaces or on eminences; these to be charged with naphtha, methylated spirit, or some other quick burning and smokeless material, that on ignition would produce a sudden and violent flame, which would cause a current of air.

How far is such a scheme practicable? As to the expense, this I imagine would be a mere trifle compared with that of the loss, and inconvenience, not to say sickness due to fog.

J. C. STENNING.

Steel Cross House, Tunbridge Wells, 23rd Dec., 1904.

IN connection with the above, we may quote the following letter from Sir Oliver Lodge, Principal of the University of Birmingham, which appeared in *The Times* of December 23rd.

To the Editor of The Times.

SIR,—The anticyclonic condition prevalent this year gave us a fine summer and is now giving us an opportunity for fog which the great towns are utilizing to the utmost by the imperfection of their combustion and by their habitual employment of crude fuel.

An electrical method of dissipation is not the right remedy for this artificially intensified evil, though it is a hopeful and proper method of attacking natural mist in places where it interferes with navigation or commerce; but, although it is not the right remedy, any more than free meals and free doles are a sound remedy for the problem of poverty, yet, like them, it may have to be used as a temporary palliative in times of stress and while better methods are incubating. The cost of applying such a method to a whole city is probably prohibitory, but there are important

centres where any means of mitigating the nuisance would seem to be legitimate.

If a deputation of municipal or other engineers chose to come to Birmingham, I would show them some apparatus at work, and they could judge how far they could recommend its experimental adoption on a larger scale. No private persons can try experiments in the thoroughfares of a city, nor can an experiment be tried on an adequate scale without some expenditure. The necessary expenditure resolves itself into initial equipment and maintenance; the actual running expense being only occasional, and, moreover, quite insignificant, compared with the power already expended in artificial illumination during daylight fog.

Whether it is worth while for any municipality to try the experiment, it is not for me to say, but it is within the scope of the electrical engineering profession, and my assistants are competent to give the specific supervision and advice necessary to insure its being tried properly, if any authority chose to attempt it.

I am, Sir, faithfully yours,

OLIVER LODGE.

The University, Birmingham, Dec. 22nd.

RAIN GAUGES.

THERE are two sources of error in rain gauges which are more important than any which have been discussed lately in this Magazine.

(1.) There is the difference in sharpness of the rim. For five years my neighbour in this village registered an average of 1·03 in. yearly more than I did, and we were unable to assign a reason; both gauges were Snowdon 5 in. On his leaving the village he allowed me to place his gauge alongside mine for some months, during which it still registered more than mine. Careful measurement showed that his gauge was a trifle wider than mine, only sufficient to cause a difference of 1 per cent., but the rim was not so sharp as mine—one of Casella's, which, as Mr. Symons said, would split a rain drop,—and the higher record was probably due to insplashing.

(2.) The other source is the difference in receptacle. Some deliver direct into the copper cylinder or bucket, others into a wide mouthed bottle; in both cases, if the gauge is not read daily evaporation comes in. A neighbour here, who only records his gauge once a month, registered actually less at the end of the month than he had found in it some days before; the weather had been dry, and his funnel delivered direct into the copper bucket of a Snowdon gauge.

Rain gauges should have rims uniformly sharp, and delivery should be into a glass bottle with a mouth only just wide enough to take the funnel pipe.

J. P. MACLEAR.

Chiddingfold, 15th October.

METEOROLOGICAL NEWS AND NOTES.

THE LARGEST NUMBER OF THIS MAGAZINE. completing the largest volume which has been issued since its foundation in 1866, is now in the hands of the reader. We could without difficulty maintain the size throughout the year, as our correspondents keep us amply supplied with material; but, although the Magazine can never be expected to become a source of financial profit, we hope that the small increase of circulation which has been observed will continue until the loss incurred in improving the Magazine is covered. The next volume will appear in the attractive cover the design of which appears as the frontispiece of the present; and if our readers care for it enough to increase the circulation sufficiently to cover the extra expense of printing and the doubled postage which any expansion demands, it lies in their power to do so. We shall not cease in our efforts to fill such space as our subscribers place at our disposal to the best of our ability.

THE PHYSICS OF THE FREE AIR—that is to say, the scientific investigation of the upper atmosphere—is the subject of a new publication appearing at irregular intervals under the title *Beiträge zur Physik der freien Atmosphäre.* The new journal is edited by Dr. Assmann, of Berlin, and Dr. Hergesell, of Strasburg, with the collaboration of eminent meteorologists in all countries.

THE ROYAL METEOROLOGICAL SOCIETY is, we understand, about to resume the series of exhibitions of meteorological iustruments, which were for some years a source of great interest to the public as well as to the Fellows of the Society.

THE COURSE OF GILCHRIST LECTURES to be delivered in January at Evesham, Stourport and Wolverhampton, and in February at Swadlincote and Atherton, will include a lecture on Climate and its Influence on Human Progress by Dr. H. R. Mill.

ASTRONOMY AND METEOROLOGY are on good terms with each other. They approach though they do not meet; but we confess to a sensation of mild surprise at the far views of a provincial journalist, who, in an eloquent tribute to the dry October, printed on November 1st, permits himself to observe—"With a regular afternoon sun and a gentle dry wind we are placidly approaching the autumnal equinox." We may add that we are also approaching the 29th of February.

REVIEWS.

Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus herausgegeben von Professor Dr. G. Hellmann. No. 15. *Schlussheft. Denkmäler Mittelalterlicher Meteorologie.* [Reprints of Works on meteorology and terrestrial magnetism. No. 15, concluding number. Monuments of mediæval meteorology.] Berlin: Asher & Co. 1904. Size 10 × 8. Pp. 46 + 270 + 12. Price 28 mk.

This beautiful volume completes the series of monumental works of the past, which Dr. G. Hellmann has brought for a moment within the reach of the students of meteorology of to-day. We say "for a moment" because the first four numbers are already out of print and the whole series is so interesting bibliographically as well as scientifically that the edition will soon be exhausted.

To this volume Dr. Hellmann prefixes an introduction dealing with the character of the meteorology of the Middle Ages, in which he says that the proverbial darkness was pierced by the light of many brilliant stars, and in confirmation of this he gives a series of most interesting notes on the works he has selected for reproduction. These are, of course, mainly in Latin, and the actual manuscripts are reproduced in many cases and always with a perfection that does the greatest credit to publishers and printers. The first chronologically is a selection from the *De Natura Rerum* of Isadorus Hispalensis (A.D. 570-636), a famous bishop of Sevile; the last is from Gregor Reisch's *Margarita Philosophica*, a miniature encyclopædia written at the beginning of the fifteenth century and printed long afterwards, in 1504. This edition, the meteorological section of which is reproduced, contains the first meteorological pictures and diagrams which figured in any printed book. The nine centuries between these two works are represented by 24 authors, including the first English historian, the Venerable Bede. The intellectual side of meteorology will always lie under a delightful debt to Dr. Hellmann for this series.

Climatological Observations at Colonial and Foreign Stations. I., *Tropical Africa*, 1900–1901–1902. *With Summaries for previous years and frontispiece map. Tables prepared by* E. G. Ravenstein. Published by the Authority of the Meteorological Council. London: Printed for H.M. Stationery Office, 1904. Size 12 × 10. Pp. 54 and Map. Price 6s.

In a short preface Dr. W. N. Shaw explains that the Meteorological Council intend to publish the observations from distant portions of the British dominions and certain foreign countries which are sent in to the Meteorological Office, and they have accepted this discussion by Mr. Ravenstein as a preliminary memoir. The first two para-

graphs of the preface explain the origin of the present publication :—

"Summaries of Climatological Observations made at a number of stations in Tropical Africa have been included in a series of reports made to the British Association by a committee appointed by that Association at the Cardiff meeting in 1891.

"The Committee, of which Mr. E. G. Ravenstein was chairman, the late Mr. G. J. Symons, Dr. H. R. Mill and Mr. H. N. Dickson were successively secretaries, Mr. Baldwin Latham and Sir John Kirk original members, prepared a book of instructions for observers, and in other ways promoted the collection of climatological information. After ten years of activity, the Committee ceased its operations, but returns of observations continued to be received, chiefly by the Foreign Office. Some of these were forwarded to Mr. Ravenstein direct and others were placed in charge of the Meteorological Council."

We rejoice to see a piece of very laborious pioneer work, the initiation of which was due to Mr. Fred. Moir, of Nyasaland, and the burden of which fell mainly on Mr. Ravenstein, taken up by an official body which will secure for it the continuity that can never be attained by individuals upon whose time other matters have prior claims. The portions of tropical Africa dealt with in this report are—The Egyptian Sudan (7 stations), Uganda (8 stations), Congo State (1 station), British East Africa (15 stations), British Central Africa (32 stations), Rhodesia (19 stations), and Portuguese Zambesia (1 station). A valuable bibliography of African tropical climatology concludes the work.

Wind Charts for the South Atlantic Ocean. London : Hydrographic Office. Size, 20 × 27, 12 charts. Price 7s.

A PUBLICATION without a title-page is something of a curiosity in bibliography, but in this instance it is also an important contribution to meteorology. A chart of the South Atlantic with a strip of the South Pacific from the Equator to 65° S. is given for each month of the year. The water-surface is ruled into squares of 5° in the side, and in each square there is a wind-rose showing the average frequency of winds from each point of the compass for that area in that month, based on the observations of a long series of years. Isobars and isotherms are also added. The work was carried out in the Marine Department of the Meteorological Office, and some glimmering of the amount of labour involved and the success achieved may be obtained by the reflection that nearly a million sets of observations have been utilized and so elaborated that the final outcome can be gathered by the eye in half-an-hour without reading a single figure. So notable an achievement deserves to be more fully described than in the scant page of letterpress accompanying the charts.

The National Physical Laboratory. Report for the year 1903. London: 1904. Size 10 × 7. Pp. 76. Plates.

THE Report of the National Physical Laboratory for 1903, in addition to the statistics of instruments tested, &c., embodies tabular statements of the meteorological and magnetic observations during the year at Kew Observatory, and the magnetic observations at Falmouth and Valencia, with notes on the work carried out On the initiative of the Meteorological Office, special observations were made with the Fineman and Strachey nephoscopes in connection with the international scheme of balloon ascents, and some observations of the upper clouds were also made. New earth thermometers were installed at 1 and 4 feet below the surface, and readings were taken three times daily. The rainfall at Kew during 1903 is stated to have been the largest recorded since exact observations began, and 80 per cent. in excess of the average of the preceding 10 years.

Physiography: an Introduction to the Study of Nature. By T. H. HUXLEY, *revised and partly re-written by* R. A. GREGORY, *Professor of Astronomy*, Queen's College, London. With 301 illustrations. London: Macmillan & Co., Ltd. 1904. Size 7 × 5. Pp. xii. + 425. Price 4s. 6d.

WHILE the work of an intellectual giant like Huxley must always stand alone when viewed from the point of view of an advanced student, the change of horizon made necessary by the discovery of new facts, and the increased facility of illustration, make it desirable to recast a book of this sort from time to time, if it is to retain its value for the class for which it was originally written. The new book is less impressive in appearance than the old, but the number of its illustrations is a merit, though the scale of some of them is regretably small. Professor Gregory has done his work well, and has turned out a book such as only an authority on education with a very wide and accurate knowledge of science could produce.

The book keeps prominently before the reader the vital fact of the Earth as a whole, with parts in constant interaction. In reading it, one is reminded how great the whole is which includes the little part, to elucidate which demands the whole attention of a specialist, and it also shows how important the specialist's part is in the grand scheme of the whole. The mutual relations of the Sun, in its actions on the Earth, with air, water and land, are clearly set out. Many of the illustrations are novel and happy, and they are all practical. Few defects have met our eye, though it is offended by the usual typographical contempt for our planet—no editor or printer would write of *the times* as a newspaper, why, we wonder, do they so often refer to *the earth* as a planet. There is one picture which might be

replaced by a better in a new edition. Fig. 56, "Fahrenheit and Centigrade divisions on a simple thermometer," shows 0° C. coincident with 31° F., and 10° C. with 49° F., whereas we all know that the coincidence of 0° C. and 32° F. is essential, and that of 10° C. with 50° F. is a very happy accident. Fig. 57 shows a maximum thermometer graduated down to —25°, while Fig. 58 shows a minimum thermometer graduated only to —10°. This must be rather puzzling for a student, who would naturally expect a minimum thermometer to be able to measure lower temperatures than a maximum.

Klimatographie von Oesterreich. I. Klimatographie von Niederösterreich [Climatography of Austria. I. Climatography of Lower Austria], von J. HANN. Wien. 1904. Size $11\frac{1}{2} \times 7\frac{1}{2}$. Pp. 104, and map. Price 3 kronen (2s. 6d.)

THIS is the first part of a work on the climate of Austria, published as a memorial of the fiftieth anniversary of the Austrian Central Meteorological Institute. Dr. Pernter, the Director of the Institute, mentions in the preface that the work will consist of sixteen parts, one for each of the crown-lands, and these must necessarily be undertaken by different hands. He invited his predecessor, Hofrat Hann, the leading climatologist in the world, to prepare the first memoir to serve as a pattern on which the others could be fashioned, and the master undertook the work, which is now before us. The province of Lower Austria is treated first as a whole, and then in greater detail for each of the four great divisions, Dr. Hann only claims to give the minimum description possible, merely a statistical skeleton on which an ideal description of the climate might be built up. The ideal referred to would include not only the facts of climate, but the relation of climate to vegetation, agriculture, and mankind; in fact, to the general life of the region in question.

The statistical basis consists of the mean, maximum and minimum of each climatological condition, together with the variability from the mean in successive periods. The barometer is left out of account, as the variations over the small surface of a province are of no direct climatological importance, though it would be considered in a general treatise on the climate of all Austria, after the partial descriptions are completed. Temperature and rainfall are the elements discussed in greatest detail, and the memoir contains a finely-executed rainfall map of Lower Austria, on the scale of about 6 miles to an inch, printed in colours. As Vienna is situated in the province dealt with, it has been possible to compare the records of shorter duration in different places with the very long series available for the capital.

Die Anomalien der Witterung auf Island in den Zeitraume 1851 bis 1900 und deren Beziehungen zu den gleichzeitigen Witterungsanomalien in Nordwesteuropa. von J. HANN. [The anomalies of the weather in Iceland during the period 1851–1900 and their relation to the simultaneous anomalies in North-Western Europe.] From *Sitzungsber. Akad. Wiss. Wien. Math.-Naturwiss. Klasse.* January, 1904. Size 9½ × 6½. Pp. 88.

A DETAILED discussion of the variations of the monthly values of the various meteorological elements for every year from the fifty years' mean in Iceland, and a comparison with the similar variations in other places. The barometric pressure, temperature and rainfall for 50 years at Stykkisholm, Iceland, are first compared with those at Greenwich, Brussels and Vienna; the pressure at Stykkisholm is then compared with that at Ponta Delgado, both of these being "centres of action," in the terminology of Teisserenc de Bort; the meteorology of Stykkisholm itself is next discussed, and finally the temperature on the east coast of Greenland opposite Stykkisholm.

Cape of Good Hope Report of the Meteorological Commission for the year 1902. Cape Town, 1903. Size 13 × 8. Pp. 178 and plate.

An Introduction to the Study of South African Rainfall, by J. R. SUTTON, M.A. From *Trans. S. African Philos. Soc.* May, 1904. Size 10 × 6½. Pp. 28. Plates.

A note on the quantities given in Dr. Marloth's paper "On the moisture deposited from the south-east clouds," by CHARLES M. STEWART, B.Sc. From *Trans. S. African Philos. Soc.* January, 1904. Size 10 × 6½. Pp. 6.

Meteorology in South Africa, a retrospect and prospect, by CHARLES M. STEWART, B.Sc. From *Rep. S. African Assoc.* April, 1903. Size 9½ × 6. Pp. 12.

Cape Town under Water, a series of Realistic Photographs with a complete description of the effects of the Great Storm of June 23rd and 24th, 1904. Cape Town: Central News Agency. Size 9½ × 12½. Pp. 16. Price 6d.

WE have had these valuable and interesting publications on our table for months, and the vision of a fitting article to do justice to the efforts now being made in South Africa to improve the study of the weather has flitted before us to the very threshold of that grave of good intentions, a new year. The list of titles would worthily serve as the text for a discourse in a quarterly review, but neither can we find time nor our little monthly space to accomplish our intention. We can only hope that before long some of our South African readers will furnish us with notes of the progress of meteorology in their country, where so much good work is being done.

RAINFALL AND TEMPERATURE, DECEMBER, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches.	inches.	in.								
I.	London (Camden Square) ...	1·79	— ·14	·64	6	19	56·3	29	27·6	9	9	19
II.	Tenterden	3·56	+ 1·33	·78	6	21	55·0	16, 29	24·0	23	8	20
,,	Hartley Wintney	2·39	+ ·25	·55	6	21	55·0	16	25·0	9, 21*c*	13	16
III.	Hitchin	2·12	+ ·18	·50	6	15	55·0	16	21·0	21, 22	15	...
,,	Winslow (Addington)	1·88	— ·13	·43	6	19	56·0	16	16·0	22	13	20
IV.	Bury St. Edmunds (Westley)	1·80	— ·31	·44	6	21	54·8	16	20·5	20, 23	...	...
,,	Brundall	2·55	+ ·47	·47	6	23	56·0	16	21·0	22	13	24
V.	Alderbury	3·29	+ ·63	·65	10	18	55·0	17, 30	26·0	9	15	...
,,	Winterborne Steepleton ...	4·20	...	·81	6	20	53·3	6	25·0	9	6	13
,,	Torquay (Cary Green)	2·74	...	·67	8	13	55·8	16	34·1	11	0	9
,,	Polapit Tamar [Launceston]	3·75	+ ·09	·47	6	23	54·0	4, 16*a*	23·5	22	8	12
,,	Bath	1·96	...	·43	6	16	56·5	16	27·5	22	11	21
VI.	Stroud (Upfield)	2·15	— ·08	·35	6	19	54·0	17	26·0	23	...	12
,,	Church Stretton (Woolstaston)	2·52	— ·02	·70	5	20	54·0	4	19·0	23	15	...
,,	Bromsgrove (Stoke Reformatory)	1·75	+ ·02	·40	11	16	52·0	16	21·0	22	21	...
VII.	Boston	1·95	+ ·40	·38	11	13	55·0	4	22·0	22	19	...
,,	Bawtry (Hesley Hall)	1·19	— ·67	·32	15	11	56·0	4	16·0	22	22	...
,,	Derby (Midland Railway)...	1·39	— ·47	·23	9, 13	18	55·0	16	20·0	22	17	...
VIII.	Bolton (The Park)	3·29	— ·39	·61	15	17	...	...	...	...	...	...
IX.	Wetherby (Ribston Hall) ...	1·57	— ·35	·25	9	15	...	...	...	...	...	...
,,	Arncliffe Vicarage	4·58	— 1·88	·55	15	19	...	...	...	...	...	...
,,	Hull (Pearson Park)	1·43	— ·77	·27	15	15	55·0	4, 5*a*	23·0	23	14	26
X.	Newcastle (Town Moor) ...	1·94	— ·49	·69	9	13	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	15·09	+ ·16	2·84	16	17	54·3	4	18·8	22, 23	18	...
XI.	Cardiff (Ely)	3·38	— ·71	·69	5	22	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	5·14	+ ·43	·74	8	21	55·1	4	27·5	24	4	12
,,	Aberystwith (Gogerddan)..	4·77	+ ·22	·92	12	16	61·0	14	20·0	23	13	...
,,	Llandudno	3·01	+ ·11	·70	17	20	60·0	4	30·0	24	5	...
XII.	Cargen [Dumfries]	3·47	— 1·25	·75	16	13	55·0	17	22·0	27	19	...
XIII.	Edinburgh (Royal Observy.)	2·40	...	·90	12	17	55·9	17	24·2	11	8	18
XIV.	Colmonell	3·72	— 1·13	·63	11	18	54·0	14*b*	26·0	8	10	...
XV.	Tighnabruaich	6·16	...	·80	6	17	48·0	4, 28	22·0	10	13	14
,,	Mull (Quinish)	4·58	— 1·67	·71	11	22	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2·08	— 1·57	·47	15	13	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	1·80	— 1·01	·35	12	18	56·1	29	17·0	11	12	...
XVII.	Braemar	1·87	— 1·14	·63	4	15	51·2	5	6·0	11	17	...
,,	Aberdeen (Cranford)	2·80	— ·18	·70	9	19	55·0	29	10·0	10	15	...
,,	Cawdor (Budgate)	2·26	— ·35	·41	29	17	...	...	...	...	...	...
XVIII.	Glencarron Lodge	10·73	+ ·30	2·38	29	25	53·4	5	15·6	11	8	...
,,	Bendamuh.	8·73	— 1·66	1·78	29	26	...	...	...	...	...	...
XIX.	Dunrobin Castle	2·45	— 1·01	·70	29	12	54·0	29	23·5	11	7	...
,,	Castletown	4·09	...	1·30	29	24	50·0	16, 28	20·0	10, 11	12	...
XX.	Killarney	5·01	— ·77	1·91	17	19	57·0	20	27·5	8	...	...
,,	Waterford (Brook Lodge)...	3·76	— ·11	·62	8	20	54·0	4	28·0	11	6	...
,,	Broadford (Hurdlestown) ...	3·36	+ ·10	·58	16	23	54·0	28	26·0	7	9	...
XXI.	Carlow (Browne's Hill)	2·09	— 1·29	·33	8	19	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·50	— ·85	·44	9	17	59·0	4	28·2	22	5	13
XXII.	Ballinasloe	3·48	— ·11	·75	16	24	64·0	4	23·0	8	13	...
,,	Clifden (Kylemore House)..	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Seaforde	2·46	— ·97	·51	9	17	54·0	4, 16	27·0	10*d*	9	16
,,	Londonderry (Creggan Res.)	3·06	— 1·06	·56	4	21	...	...	...	...	...	...
,,	Omagh (Edenfel)	2·85	— 1·09	·50	16	21	54·0	4	25·0	8	11	21

+ *Shows that the fall* was above the average; that it was below it. *a*—and 17. *b*—and 15, 16. *c*—and 22, 23. *d*—and 11, 18.

SUPPLEMENTARY RAINFALL, DECEMBER, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	3·33	XI.	New Radnor, Ednol	3·21
,,	Sheppey, Leysdown	1·93	,,	Rhayader, Nantgwillt	5·14
,,	Hailsham	3·19	,,	Lake Vyrnwy	5·08
,,	Crowborough	4·43	,,	Ruthin, Plâs Dràw	3·19
,,	Ryde, Beldornie Tower	3·20	,,	Criccieth, Talarvor	3·97
,,	Emsworth, Redlands	3·42	,,	Anglesey, Lligwy	2·59
,,	Alton, Ashdell	3·48	,,	Douglas, Woodville	3·25
,,	Newbury, Welford Park	2·43	XII.	Stoneykirk, Ardwell House	2·80
III.	Harrow Weald	2·14	,,	Dalry, Old Garroch	5·85
,,	Oxford, Magdalen College	1·78	,,	Langholm, Drove Road	4·55
,,	Banbury, Bloxham	1·56	,,	Moniaive, Maxwelton House	4·37
,,	Pitsford, Sedgebrook	1·65	,,	Lilliesleaf, Riddell	2·18
,,	Huntingdon, Brampton	1·78	XIII.	N. Esk Reservoir [Penicuick]	3·60
,,	Wisbech, Bank House	1·65	XIV.	Maybole, Knockdon Farm	3·04
IV.	Southend	1·45	,,	Glasgow, Queen's Park	3·41
,,	Colchester, Lexden	1·91	XV.	Inveraray, Newtown	7·92
,,	Saffron Waldon, Newport	2·01	,,	Ballachulish, Ardsheal	9·99
,,	Rendlesham Hall	2·16	,,	Campbeltown, Redknowe	4·66
,,	Swaffham	1·48	,,	Islay, Eallabus	4·20
,,	Blakeney	1·87	XVI.	Dollar	5·55
V.	Bishop's Cannings	2·53	,,	Balquhidder, Stronvar	9·51
,,	Ashburton, Druid House	4·71	,,	Coupar Angus Station	2·16
,,	Okehampton, Oaklands	4·47	,,	Blair Atholl	3·33
,,	Hartland Abbey	3·23	,,	Montrose, Sunnyside	2·01
,,	Lynmouth, Rock House	3·32	XVII.	Alford, Lynturk Manse	2·38
,,	Probus, Lamellyn	4·46	,,	Keith, H.R.S.	3·72
,,	Wellington, The Avenue	2·55	XVIII.	Fearn, Lower Pitkerrie	1·96
,,	North Cadbury Rectory	3·27	,,	S. Uist, Askernish	...
VI.	Clifton, Pembroke Road	2·32	,,	Invergarry	6·66
,,	Moreton-in-Marsh, Longboro'	2·16	,,	Aviemore, Alvie Manse	3·13
,,	Rosa, The Graig	2·19	,,	Loch Ness, Drumnadrochit	3·78
,,	Shifnal, Hatton Grange	1·86	XIX.	Invershin	2·78
,,	Wem Rectory	1·60	,,	Altnaharra	5·79
,,	Cheadle, The Heath House	1·89	,,	Bettyhill	3·76
,,	Coventry, Kingswood	1·97	,,	Watten, H.R.S.	2·46
VII.	Market Overton	1·67	XX.	Cork, Wellesley Terrace	2·76
,,	Market Rasen	1·76	,,	Darrynane Abbey	4·21
,,	Worksop, Hodsock Priory	1·20	,,	Glenam [Clonmel]	2·96
VIII.	Neston, Hinderton	2·38	,,	Ballingarry, Hazelfort	2·14
,,	Southport, Hesketh Park	2·38	,,	Miltown Malbay	4·20
,,	Chatburn, Middlewood	3·22	XXI.	Gorey, Courtown House	2·53
,,	Duddon Valley, Seathwaite Vic.	7·54	,,	Moynalty, Westland	2·55
IX.	Langsett Moor, Up. Midhope	3·30	,,	Athlone, Twyford	2·65
,,	Baldersby	2·02	,,	Mullingar, Belvedere	2·23
,,	Scalby, Silverdale	2·68	XXII.	Woodlawn	3·87
,,	Ingleby Greenhow	3·37	,,	Westport, Murrisk Abbey	3·75
,,	Middleton, Mickleton	1·83	,,	Crossmolina, Enniscoe	4·82
X.	Beltingham	1·88	,,	Collooney, Markree Obsy	3·76
,,	Bamburgh	1·34	XXIII.	Enniskillen, Portora	...
,,	Keswick, The Bank	6·73	,,	Warrenpoint	2·22
,,	Melmerby Rectory	3·23	,,	Banbridge, Milltown	1·85
XI.	Llanfrechfa Grange	3·43	,,	Belfast, Springfield	2·95
,,	Treherbert, Tyn-y-waun	8·45	,,	Bushmills, Dundarave	3·27
,,	Llandovery, Tonn	3 87	,,	Stewartstown	2·53
,,	Castle Malgwyn	5·08	,,	Killybegs	4·39
,,	Llandefaelog-fach	...	,,	Horn Head	4·00

METEOROLOGICAL NOTES ON DECEMBER, 1904.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A mild, gloomy and depressing month, with great absence of sunshine and much damp, foggy weather. From the morning of the 19th till about 11 a.m. on 23rd, London was continuously developed in more or less dense fog. A westerly gale on 30th did considerable damage. Duration of sunshine 15·3* hours, and of R 39·6 hours. Mean temp. 41°·0, or 1°·8 above the average. The total duration of rainfall for the year was 492 hours on 160 days, and of bright sunshine 1,252 hours on 256 days.

TENTERDEN.—Very wet from 4th to 14th, but dry in the latter half, and beautiful from 19th to 22nd. Violent W. to N.W. gale on 30th. Duration of sunshine 48·2† hours.

CROWBOROUGH.—Wet and mild, escaping much of the fog experienced elsewhere. Mean temp. 41°·5.

HARTLEY WINTNEY.—Cold, damp and gloomy, with great lack of sunshine. Frost and R alternated during the first fortnight, in the latter raw, penetrating fog prevailed, lasting 10 days. Ozone on 12 days, with a mean of 5·0.

BRUNDALL.—Ungenial, with much R followed by fogs. Great wind storm on 30th, doing much damage. Mean temp. 39°·4, or 0°·9 above the average.

TORQUAY.—R 1·16 in. below the average. Duration of sunshine 53·4* hours, or 0·1 hour above the average. Mean temp. 46°·6, or 3°·1 above the average. Mean amount of ozone 4·8.

WELLINGTON.—The first 15 days had R, but not in large quantities; the latter part was generally dry, but with dense fog at times before Christmas.

NORTH CADBURY.—Very humid and cloudy, but warm and exceedingly calm.

CLIFTON.—R every day till 17th, with short fine intervals. An anti-cyclone then set in, bringing after one clear day dull, raw and foggy weather, with easterly winds changing to S.W. on 27th with a great increase of temp. S.W. to W. gale on the night of 29th. R one inch below the average.

ROSS.—R daily from 2nd to 17th, with max. temp. above 50° on 10 days. From 19th to 28th was raw, cold and unpleasant, with continual fog. No severe frost, but much low temp.

WOOLSTASTON.—Exceedingly variable temp., with S on five days. Dense fog from 22nd to 25th. Tremendous gale on 29th and 30th.

WORKSOP.—Changeable, with a good deal of slight frost, but no severe cold. Much fog about Christmas.

SOUTHPORT.—Mild and unusually sunny until 8th, and then cold, calm and remarkably foggy till 28th. Mean temp. 0°·4 below the average. Duration of sunshine 13 hours above the average. R ·69 in. below the average. Underground water level exceptionally low.

LLANFRECHFA GRANGE.—Mild till 22nd, when sharp frost set in for 2 days, and much thick fog in the latter part. Heavy gale on the night of the 29th.

HAVERFORDWEST.—Wet, stormy and mild till 17th, after which a dry period set in with considerable fall in temp., and much fog and gloom. Sudden N.W. gale on the night of the 29th. Duration of sunshine 27·6* hours on 13 days.

DOUGLAS.—An open month, with many beautiful days. Some S fell on 7th. Gloomy from 19th to 27th, but no real fog. Gales on 6 days, that on 29th, occurring with high bar., being exceptionally severe.

SCOTLAND.

LANGHOLM.—R 1·07 in. below the average of 28 years. Several gales, the most severe being from N.W. on the night of the 29th.

---

* Campbell-Stokes. † Jordan.

MAXWELTON HOUSE.—Very fine, with some high winds, but mostly quite calm or with light breezes. Farmers quite contented.

COUPAR ANGUS.—Mean temp. 35°·2, or practically the average of 25 years. Cold snap during the second week, the min. reaching 8° on 11th, but the duration of the cold weather was short, and it did not affect the mean much. R slightly below the average.

DRUMNADROCHIT.—R ·49 in. below, and rainy days 3 above, 18 years' average.

WATTEN.—The first half was stormy, with R and S; then ten days of fresh, open, calm and mild weather, and at the close stormy with heavy R and gale.

CASTLETOWN.—The first part was very wet, with S from 6th to 11th. The latter part was damp and overcast. Strong northerly gale on 30th.

IRELAND.

CORK.—R 1·69 in. below the average. Gales on 4th and 8th, and a storm on 16th and 17th. Prevailing winds S.E. and E. Dense fog on 2nd.

DARRYNANE.—Very mild, with some fine spring-like days. The last 10 days were foggy. R 73 per cent. of the average of 20 years.

WATERFORD.—A long spell of easterly winds at the end, and a good deal of fog. Mean temp. 43°·1.

MILTOWN MALBAY.—The first half was cold, with much R and H and some S, with squalls and boisterous winds. Mild and dry in the second half.

MARKREE OBSERVATORY.—On the whole exceptionally fine and mild, though the first part was rather wet.

BELFAST.—Frost in the first half, followed by very dull foggy weather. The finest December since 1890.

OMAGH.—Rainy and unsettled up to 19th. Remainder mild, stagnant and hazy with but little rain except on the last three days.

THE TWELVE MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—December, 1904. (*See* p. 221.)

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	20·65	91	Arncliffe	56·31	91	Braemar	25·00	72
Tenterden	25·22	96	Hull	21·25	85	Aberdeen	26·13	82
Hartley Wintney	23·88	95	Newcastle.....	23·43	90	Cawdor	22·68	75
Hitchin	21·65	93	Seathwaite ...	130·04	97	Glencarron ...	89·55	95
Winslow	22·36	94	Cardiff	43·26	109	Dunrobin	27·56	89
Westley.....	20·69	82	Haverfordwest	42·96	99	Killarney ...	51·12	93
Brundall.....	21·50	86	Gogerddan ...	44·83	100	Waterford ...	41·12	107
Alderbury	27·53	100	Llandudno ...	25·98	85	Broadford.. ...	38·74	116
Ashburton	50·26	101	Dumfries	38·91	89	Carlow	32·06	95
Polapit Tamar ...	43·35	118	Lilliesleaf	27·75	92	Dublin	22·19	81
Stroud	26·79	100	Colmonell	43·22	99	Mullingar.....	33·90	107
Woolstaston	26·66	92	Glasgow	34·65	95	Ballinasloe ...	39·27	107
Boston	20·32	101	Inveraray	70·65	98	Clifden	..	...
Hesley Hall	19·37	91	Islay	51·73	111	Crossmolina ...	59·72	114
Derby.....	19·91	88	Mull	57·95	103	Seaforde	33·97	94
Bolton	34·74	84	Loch Leven ...	31·88	89	Londonderry..	41·74	101
Wetherby	25·61	108	Dundee	24·70	90	Omagh	42·89	108

Climatological Table for the British Empire, July, 1904.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver Cloud.
	°		°		°	°	°	0-100	°	°	inche-		
London, Camden Square	88·9	17	49·7	4	77·7	56·4	57·9	76	133·2	45·2	2·41	10	5·0
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	81·2	31	36·9	21	64·3	48·9	49·6	79	...	...	2·47	9	4·6
Durban, Natal	80·3	14	49·3	23	74·0	54·5	...	...	127·3	...	1·89	7	2·0
Johannesburg	67·0	10	34·0	26	60·2	42·4	31·4	50	...	28·5	·02	1	6·0
Mauritius	76·2	22	51·3	30	74·1	59·4	59·0	77	138·6	43·4	2·09	18	5·2
Calcutta	93·2	12	75·0	7	87·1	78·3	77·1	87	153·8	73·9	20·62	17	8·7
Bombay	87·3	1	75·3	5	85·4	78·1	76·4	83	134·2	74·0	10·14	25	8·5
Madras	101·0	7	73·3	25	96·0	77·9	70·9	67	144·6	72·0	6·18	18	6·5
Kodaikanal	65·6	27	49·6	19*a*	61·7	51·7	51·0	84	146·2	45·2	4·27	21	2·4
Colombo, Ceylon	85·2	24	71·8	5	83·6	76·2	72·9	83	146·0	70·0	8·94	19	8·1
Hongkong	90·0	29	74·2	2	85·9	77·9	75·2	82	149·6	...	7·23	17	7·6
Melbourne	64·4	23	31·5	23	63·1	31·5	42·8	83	117·8	26·6	1·57	12	6·4
Adelaide	62·6	25	36·9	29	58·1	44·8	44·9	81	120·3	30·8	2·73	15	5·8
Coolgardie	67·2	4	32·0	14	58·6	41·2	40·4	70	136·9	23·5	1·90	8	5·8
Sydney	67·7	14	40·7	19	58·2	47·6	44·1	82	99·0	32·9	11·06	21	5·9
Wellington	57·9	20	32·0	3	51·7	41·5	40·6	79	97·0	29·0	4·29	15	7·6
Auckland	61·0	11	37·0	23	56·7	49·9	44·9	80	115·0	33·0	2·24	11	5·0
Jamaica, Negril Point	89·9	8	69·7	25	86·7	72·2	72·7	77	...	...	6·91	9	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	..	...
Grenada	85·8	25	68·8	11	82·0	74·3	70·1	75	147·2	...	8·71	28	4·5
Toronto	92·0	18	48·1	3	76·4	58·2	59·2	76	121·7	41·5	5·13	11	5·2
Fredericton	86·1	20	45·0	4	79·2	56·5	60·3	61	...	...	1·48	7	6·2
Winnipeg	85·2	16	42·5	1	74·4	52·2	...	...	...	...	5·55	15	5·0
Victoria, B.C.	82·3	21	49·0	14	68·9	52·7	...	...	...	...	·48	5	3·8
Dawson	75·0	18	39·0	25	69·0	46·2	...	...	...	...	2·14	10	5·1

a and 26.

Mauritius.—Mean temp. of air 1°·2, dew point 0°·4, and rainfall ·11 in., below averages. Mean hourly velocity of wind 9·8 miles, or 2·1 miles below average.

MADRAS.—Bright sunshine 136·7 hours, or 34·6 per cent. of possible. TS on 5 days.

KODAIKANAL.—Bright sunshine 116 hours.

COLOMBO.—Mean temp. of air 79°·2, or 1°·5 below, of dew point 0°·4 below, R 4·46 in. above, averages. Mean hourly velocity of wind 9·9 miles; prevailing direction S.W.

HONGKONG.—Mean temp. of air 81°·1. Sunshine 147·4 hours. Mean hourly velocity of wind 10·9 miles; direction S.S.W.

Adelaide.—Mean temp. of air 51°·4. R ·19 in. above average.

Sydney.—Mean temp. of air 0°·6 above, R 6·31 in. above, and humidity 5·2 per cent. above, averages.

Wellington.—Mean temp. of air 1°·0 below, and R 1·57 in. below, averages.

Auckland.—Mean temp. of air close to average, and R less than half the average of previous 36 years.

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Symons's Meteorological Magazine.

No. 469. FEBRUARY, 1905. Vol. XL.

OUR NEW VOLUME.

The commencement of the fortieth annual volume of a magazine devoted to any branch of science is an occasion of some interest, not diminished by the fact that the magazine really began under a different name three years before the issue of the first number bearing its present title. Mr. Symons issued his first "Monthly Rainfall Circular" of 2 pp. in 1863, increased its size to 4 pp. in 1865, and developed it into "Symons's Meteorological Magazine" in 1866, though the transition was less abrupt than might be supposed, for the Magazine at first consisted of only eight pages. In 1868 the number of pages was increased to sixteen, and this remained the minimum until in 1904 it was increased to twenty pages.

The Magazine has always been an organ of independent opinion and impartial information regarding the progress of the scientific study of the atmosphere. We believe that it fills a useful if unobtrusive place by the punctual publication of meteorological news, and by affording a common meeting ground for the amateur observer and the scientific student. The climatology of the United Kingdom and of the British Dominions beyond the Sea has always been a special feature, though the world-wide interests of meteorology are not neglected. We believe that the utility and interest of the Magazine will still increase, and that the greater attention now being paid to meteorology in English-speaking countries will bring more contributions to our pages alike from observers and students.

Not the least interesting fact about the publications of the British Rainfall Organization is that, though in recent years there have been three changes in editorship, continuity has been preserved unbroken —the same publisher and the same printer having continued to issue them during the forty-five years of their existence. How great the services of a printer can be when his heart is in his work none but

an editor can understand, and on the occasion of the commencement of this volume, we have asked our esteemed friend and printer, Mr. Shield, to contribute a few words of reminiscence.

I became acquainted with Mr. Symons in the year 1858, on the occasion of his reading a paper to the Young Men's Association connected with the Presbyterian Church in Chelsea, of which I was a member. The exact title of his paper I am unable to verify, but it contained some interesting particulars in connection with Rainfall, and I think it is not improbable that it formed the basis of the treatise which he subsequently published under the title of "Rain: How, When, Where, and Why it is Measured." The acquaintance then formed with Mr. Symons ripened into friendship, and in 1860 he entrusted me with the printing of his first leaflet of rainfall statistics from 168 stations in England and Wales. Under his able and painstaking editorial guidance, the little leaflet gradually expanded into the annual volume of "British Rainfall," with returns from 3400 stations in every part of the United Kingdom; and it has been my pleasure to take a humble but necessary part in the production of every annual volume.

The *Meteorological Magazine* was started in 1866, and in conducting it Mr. Symons was an ideal editor from a printer's point of view—his copy was always supplied in good time; he had a keen eye for the detection of errors, typographical or other; and an apparently intuitive ingenuity in fitting in any alterations required in proof to avoid "over-running." The Magazine continues to pursue the "even tenour of its way," gradually increasing in size and circulation; and I have literally had a "hand" in the composition of every number from its first appearance to the present time.

G. W. C. SHIELD.

THE HIGH BAROMETER OF JANUARY, 1905.

THE anticyclone which spread over the British Isles in the last week of January led to some very high barometer readings in the south of England and Ireland, and we have received a large amount of correspondence on the subject, a selection of which is quoted below.

The barometer in London on January 27th and 28th has only twice been surpassed since any record has been kept, viz., on January 9th, 1825, when 30·958 in. was recorded by Belville at Greenwich, and on January 18th, 1882, when 30·975 in. was observed at Camden Square, the readings quoted being corrected to 32° and sea-level, but not reduced to standard gravity.

Unfortunately, the Redier mercurial barograph at Camden Square has a range too limited to take account of extremely high readings, and for 77 hours from 4 p.m. on January 26th to 9 p.m. on January 29th the float in the short arm of the syphon was aground on the bend of the tube. During the whole of that time the barometer was continuously above 30·820 in. The standard Fortin barometer was read at frequent, though necessarily irregular, intervals, and the results were as follows:—

Jan.	in.	Jan.	in.	Jan.	in.
26th— 9.0 p.m.	30·849	28th—10.15 a.m.	30·914	29th— 1.0 a.m.	30·954
11.10 ,, ...	·854	11.0 ,, ...	·910	4.15 ,, ...	·926
27th— 9.0 a.m.	·927	12.0 noon	·897	9.0 ,, ...	·952
10.30 ,, ...	·913	3.15 p.m.	·871	10.20 ,, ...	·947
4.30 p.m.	·893	5·45 ,, ...	·901	1.0 p.m.	·905
9.0 ,, ...	·885	7.0 ,, ...	·912	2.0 ,, ...	·896
10.0 ,, ...	·894	9.0 ,, ...	·933	4.15 ,, ...	·875
11.0 ,, ...	·904	10.15 ,, ..	·948	9.0 ,, ...	·834
12.0 mid.	·896	11.0 ,, ...	**·955**		
28th— 9.0 a.m.	·915	12.0 mid.	**·955**		

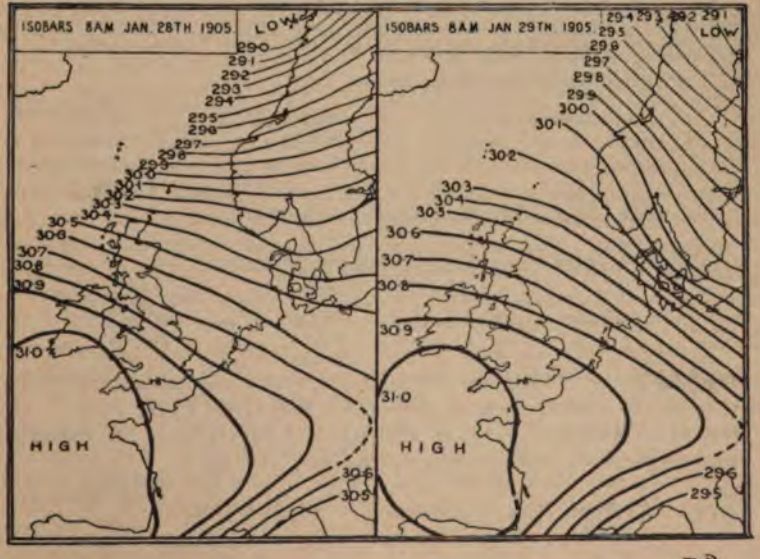
The mercury has now exceeded 30·900 in. on four occasions since the record commenced in 1858. The maxima were :—

	in.		in.
Jan. 18th, 1882—10.30 a.m. ...	30·975	Jan. 30th, 1896—11 a.m.	30·927
Jan. 9th, 1896—9 p.m.	30·934	Jan. 28th, 1905—11 p.m. & mid.	30·955

In January, 1902, when the highest recorded pressure in the British Isles, 31·113 in., was attained at Aberdeen, the south of England lay outside the area of maximum pressure ; but, as was stated in this Magazine for February, 1902 (Vol. **37**, p. 5), the maximum at Camden Square was 30·874 in. The tendency of abnormally high pressures to occur in pairs, separated by about three weeks, which was pointed out by Mr. C. L. Brook on that occasion (Vol. **37**, p. 6 and p. 23), has been exemplified in the present instance by the maxima at Camden Square—

	in.		in.
Jan. 1st, 1905—7.30 p.m.	30·790	Jan. 28th—11 p.m.	30·955

The 1902 maximum was certainly the more remarkable because



B 2

the area with pressures over 31 in. was larger than in 1905 and occurred in a part of the country where the pressure is normally lower than in the south-west.

The general distribution of pressure over north-western Europe is very clearly shown in the two charts we copy from the *Daily Weather Report* of the 28th and 29th—the one before, the other after, the highest pressure occurred. The extension of the Atlantic anticyclone, it will be observed, spread over our islands from the Bay of Biscay on the south, and the pressure appears to have exceeded 31·000 in. only in the south of Ireland, the south-west of England and Wales, and the west of France. So far as we have been able to ascertain, the highest recorded was 31·097 inches at Falmouth Observatory ; but higher readings may have been obtained in Ireland or on vessels near the mouth of the English Channel. The unusual range in pressure of 2 in. of mercury between Ireland and the north of Norway occurred on the 28th. As on previous occasions when an anticyclone with exceptionally high pressures was experienced, the weather throughout was fine, clear, and comparatively warm.

THE following is a selection from the large and interesting correspondence that has reached us on the subject of the high barometer, and the two weather-charts reproduced on the previous page are in close accord with the figures cited below :—

To the Editor of Symons's Meteorological Magazine.

For the fourth time in my record of 26 years the barometer has exceeded 30·900 in.

On January 29th, from 9 a.m. to 10 a.m., the reading was **30·923** in., having previously attained almost, if not quite, the same height from 3 a.m. to 5 a.m.

The three other occasions were—

			in.
1882.	January 18th	9.45 a.m.	30·928
1896.	,, 9th	1-1.45 p.m.	31·021
1902.	,, 31st	11 a.m.	30·951

CHARLES L. BROOK.

Harewood Lodge, Meltham. February 2nd, 1905.

The barometer here gave the following readings :—

	9 a.m. in.	9 p.m. in.
January 27th	30·926	30·887
,, 28th	30·910	30·920
,, 29th	30·940	30·835

30·940 in. at 9 a.m. on January 29th was the actual maximum, though the mercury remained at that height till about 10 a.m., and was as high at the previous midnight. The readings are corrected for temperature and reduced to sea-level.

G. SEARLE.

30 Edith Road, West Kensington, January 31st, 1905.

The sea-level pressure here at the end of last month was without precedent in a record of 32 years :—

		in.			in.
On the	27th at 9 a.m. it was	30·93	.....	at 9 p.m.	30·96
,,	28th ,, 9 a.m. ,,	30·98	.....	,, 9 p.m.	30·98
				,, 10.30 p.m.	**31·002**
,,	29th ,, 9 a.m. ,,	30·993	.....	,, 4 p.m.	30·92
				,, 9 p.m.	30·87

From 6 a.m. on the 27th to 6 p.m. on the 29th, a period of 60 consecutive hours, it was continuously above 30·90 in.

Mine is a standard barometer, Kew pattern, and is verified.

FREDK. SLADE.

Beckford, Tewkesbury, 2nd February, 1905.

The reading of the Kew verified Fortin standard barometer, corrected to 32° and sea-level, was :—

			in.
January 27th	9 a.m.		30·988
	10 a.m.		30·991
,, 28th	9 a.m.		31·010
	10.30 a.m.		31·015
	9 p.m.		31·005
	11 p.m.		31·017
	11.30 p.m.		**31·021**
,, 29th	9 a.m.		31·011 (bar. falling)

E. L. M. COLVILE.

Kempsey, Bournemouth, January 31st, 1905.

My barometer is exceptionally high ; this morning **31·03** in., and yesterday 31·02 in. The highest recorded before was 30·90 in. on 16th January, 1902.

E. PIRIE-GORDON.

Gwernvale, Crickhowell, S. Wales, 28th January, 1905.

I enclose observations for the late high barometer, unprecedented at least in S. Devon, where I have resided since September, 1876. The previous maxima which I have observed were 30·980 in. at 11 a.m. on January 18th, 1882, at Babbacombe, Torquay, and 30·940 in. at 11 p.m. on January 29th, 1896, at Rose Villa, Tavistock.

The highest and lowest pressures recorded on each day are alone transcribed :—

		Highest. in.		Lowest. in.
January 27th,	11 p.m.,	31·050	..... 2.40 p.m.,	30·961
,, 28th,	11 a.m. & midnt.,	31·054	..... 8 p.m.,	31·017
,, 29th,	0.40 a.m.,	**31·067**	..... 11.20 p.m.,	30·898

The barometer was above 31·00 in. continuously from 9.17 p.m. on the 27th until noon on the 29th, a period of 39 hours.

EDWIN E. GLYDE.

Statsford, Whitchurch, Tavistock, February 3rd, 1905.

I am sending you a selection of the tabulated hourly values of the barograph at the Falmouth Observatory on the 28th instant.

The abnormally high reading of **31·097** in. at 11 a.m. is the highest recorded here since the barograph was fixed in 1870. The nearest approach was on the 18th of January, 1882, when it reached 30·981 in.

The readings have been corrected and reduced to 32° at mean sea-level. The weather on the 28th was mild, with uninterrupted sunshine, and light airs from the N.N.W. to N.W.

The barograph belongs to the Meteorological Council.

Falmouth Observatory.—Tabulated Hourly Values of the Barograph at certain hours on the 28th of January, 1905.

		in.			in
9 a.m.	.....	31·062	Noon	.....	31·086
10 a.m.	.....	31·095	1 p.m.	.....	31·068
11 a.m.	.....	**31·097**	2 & 3 p.m.	.....	31·046
From which point the mercury rose to at			10 p.m.	.....	31·069
			11 p.m.	.....	31·081
			Midnight	.....	31·091

Falmouth, 31st January, 1905. W. L. FOX.

Correspondence.

A PARALLEL.

DURING the days of abnormally high pressure at the end of January references have been frequent to the high pressure of January 9th, 1896.

Will you allow me to point out that the resemblance between the January, 1896, and January, 1905, extends much beyond this?

Not only was the average barometer reading for the whole month exceedingly high in each case, but each of those months saw *two* waves of extraordinarily high pressure—the *first* culminating in 1896 on the 9th, and in 1905 on the 1st and again in less degree on the 10th; the *second* culminating in 1896 on the 29th, and in 1905 on the 27th, 28th and 29th.

Further, each of those Januaries saw one, and only one, considerable depression, on the 16th in each case. In each month the rainfall was very low; the wind average, as might be expected, also very low; and each month, though seasonable and fairly warm, was free from extremes of temperature.

February, 1896, had a barometer average all but equal to that of the January preceding; had *no* deep depression, and very few days with even moderately low readings; very small rainfall, and the same seasonable weather without extremes.

It will be interesting to see whether February, 1905, follows this pattern. To say so much is not to make a prediction that it *will* do so.

H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, Somerset, Feb. 1st, 1905.

THE GREAT PROBLEM OF METEOROLOGY.

By L. C. W. Bonacina.

All who take an intelligent interest in the weather—that is to say, all who remember its varying phenomena accurately—will be aware, though they may not directly recognise the fact, that each succeeding season, each succeeding month, and each succeeding day, possesses its own distinctive meteorological character. The weather, in other words, is in reality infinitely varied, by which we mean that the movements of the atmosphere, unlike those of many of the heavenly bodies or of certain involuntary muscles like the heart, do not represent a cycle of changes, but are of such a nature that the atmospheric conditions of the globe at each instant of time differ from those of any past and of any future time.

But this infinite variety of atmospheric conditions is intimately associated with another most important aspect of weather changes—namely, the Recurrence of Type. The same type of weather conditions is, as is well known, constantly recurring, but identical conditions, so far as we can tell, never do. Now it must be clearly understood upon what authority we make this assertion. As it was pointed out in a former article,* the precise distribution of atmospheric pressure that prevails at any instant of time over the Earth's surface must be regarded as the product of certain main factors, the differences in the weather of corresponding dates of different years being ascribed to the dependence of existing conditions upon previous conditions. It is, of course, quite within the sphere of possibility, that at some two points of time in the history of the globe, atmospheric conditions may have been identical, inasmuch as they are often very similar, but the chances in favour of such a contingency must be extremely small, and we are accordingly justified in assuming that identical atmospheric conditions have never occurred and never will.† This is, after all, a principle of widespread significance in nature. Consider the impressive and sublime spectacle of a wild and stormy sea beating against a rugged coast line; never do the waves strike the cliffs in exactly the same manner, and never is the surface of the sea exactly the same with regard to its motion.

Or reflect, again, upon the behaviour of a moorland stream as it leaps irregularly over a ledge of rock. Now, though the force of gravity is constant, the water will always at any particular time fall

* See this Magazine for May, 1904, p. 62.

† In the present state of our knowledge of the dynamics of moving fluids, it would be presumptive to declare that different atmospheric conditions *could not lead* to identical ones, but if this ever were to happen, a cycle of weather changes would at once be born. Such an occurrence, however, is, as we have observed above, immensely improbable, the atmospheric conditions at any moment over the globe always apparently leading to others which from the point of view of their *minutiæ* are such as have never before obtained.

over the ledge in a somewhat different manner, and this will be the case even if the amount of water leaving the tarn remains unaltered; in the latter case there is obviously only one cause to which we can attribute the ever-varying mode of fall of the water over the ledge of rock—namely, the dependence of the movements of the water at one moment upon those at the previous moment. But as soon as the outflow of water from the tarn begins to increase or decrease, an extra and all-important cause of variation in the manner in which the water will behave in its subsequent course down the fell-side commences to operate.*

As the Earth's position in the Solar System—turning once more to the main subject—remains as it must do constant, and as the amount of solar radiation received by the Earth from year to year also remains practically constant, there can only be one cause responsible for the diverse weather conditions of corresponding seasons that form so interesting and puzzling a characteristic of the climatology of, for instance, the British Isles, and this cause is the dependence of one type of weather upon another. Blizzard conditions may usher in the first of January in England one year, a mild and humid atmosphere will as likely as not mark its entry the next.

Why should atmospheric conditions so different prevail on two corresponding dates? Because on these two occasions the distribution of atmospheric pressure has been different. But what is the origin of this differenee in the distribution of atmospheric pressure? This then is the x, the unknown quantity in meteorological problems, and until the value of x has been deduced all attempts to forecast the weather for more than a short period in advance must be futile.

All scientific men know that the movements of the atmosphere are the result of solar radiation, that all meteorological phenomena have their ultimate origin in the same source, and that whatever type of weather may be dominating the atmosphere over any given area of the Earth's surface as the result of secondary causes, this very type of weather is itself modified by the amount of heat received by this area at the time.

The real problem at issue, then, is—given an atmosphere set in motion by the Sun's rays, how do its movements as a whole govern those of its various parts? We possess a tolerably clear conception of the nature of the influence of solar and terrestrial radiation upon the atmosphere, so that the thermo-dynamic aspect of the problem may therefore for the present be disregarded. We also know how

* This principle, of course, does not apply to a fluid *commencing* to move from a state of rest; the force remaining constant it will always respond to its action in the same manner; it is motion once established that affects subsequent motion. Thus in a cistern, natural or artificial, filling at intervals to overflowing, each overflow will be alike, because we may regard the body of water in the cistern as being in a state of rest so long as there is no violent internal agitation.

axial rotation modifies atmospheric circulation. Accordingly x represents the unknown laws which govern the internal motion of a circulating fluid. Let us turn for a moment to some of the recent synoptic charts of the Meteorological Office.

At 8 a.m. on November 24th, 1904, we find that atmospheric pressure was high to the west of Ireland, low over southern Sweden; over central England temperature was very low, 17° F. at Oxford, 15° F. at Nottingham; snow had fallen generally, in very large quantities in the bleak moorland districts of Scotland and the north of England. If now we turn to the chart for 8 a.m. on December 5th, 1904, we find the centre of a deep cyclonic disturbance situated north of Scotland; temperature was everywhere relatively high and rain had fallen heavily in the north of Scotland. We simply refer to these two charts (we might have taken any two) to illustrate what appears to us a fundamental truth, that the severe frost of the morning of November 24th was *à priori* related to the wet, mild and stormy weather of December 5th, and that had a different type of weather prevailed on November 24th, the deep depression of December 5th would either not have appeared when and where it did, or else would have appeared in a modified form—that is to say, it would have been of different size, shape, depth and intensity. We perceive the relation between the weather of those two dates, but are unable at present to ascertain its nature.

Now so long as we have to profess nescience concerning the nature of this fundamental principle underlying the sequence of meteorological phenomena, we might as well while, for instance, admiring some fine specimen of sylvan growth, attempt to predict from the health of the tree and the force and direction of the wind how, when and where each of its leaves will fall to the ground as attempt to infer from present atmospheric conditions what these will be a month hence. How then are we to determine the relation subsisting between different types of weather, and to solve the great problem of meteorology? It behoves theory to advance side by side with observation and experiment. The mathematician and physicist applying the methods of the calculus will have to show us how the gaseous envelope of the Earth, excited by thermal agency into activity, modified by axial rotation, breaks up at any instant into a system of eddies, how this system of eddies leads to others, and so on for all time. On the other hand, it is incumbent upon the practical geographer to remove as far as possible the great difficulties which prohibit meteorological observations from being received from all quarters of the globe, for obviously mathematical and physical knowledge would be of little avail in forecasting future states of weather if the existing state were unknown.

If it were occasionally possible to obtain simultaneous meteorological observations (ignoring local time) from various parts of the globe, so that charts could be constructed showing the atmospheric conditions prevailing both at sea level and at some suitable fixed

altitude above it, and if the nature of atmospheric circulation were at the same time thoroughly understood, the present empirical method of long-period weather forecasting which, it will be unnecessary to remark, is altogether worthless, would soon become resolved into one involving the scientific processes of inference and deduction.

AUTUMN RAINFALL AND YIELD OF WHEAT.†

By W. N. Shaw, Sc.D., F.R.S.

In the course of an inquiry into the distribution of rainfall and other meteorological elements in the seasons of the last 21 years, a relationship has been disclosed between the autumn rainfall and the subsequent yield of wheat, which is so remarkable, that it deserves special notice. For the purpose of this comparison "autumn" must be understood to mean the period from the 36th to the 48th week (both inclusive) of the year, as dealt with in the *Weekly Weather Report*. The 13 weeks cover approximately the months of September, October, and November, and the rainfall is that given in the *Weekly Report* for the "Principal wheat-producing districts." The figures for each year are shown in the following table; the year given is the year in which the crop was gathered, the corresponding rainfall is that of the previous autumn. The figures for the yield of wheat express in bushels per acre the average yield for England as given in the annual returns of the Board of Agriculture, rounded off to the nearest half-bushel.

Year.	Yield of Wheat.	Previous Autumnal Rainfall.	Year.	Yield of Wheat.	Previous Autumnal Rainfall.
	Bushels per Acre.	inches.		Bushels per Acre.	inches.
1884	30	8·5	1896 ...	*34	7·9
1885	31·5	5·2	1897 ...	29	10·0
1886	27	10·2	1898 ...	35	5·0
1887	*32	7·8	1899 ...	*33	7·5
1888	*28	7·0	1900 ...	28·5	8·0
1889	30	7·0	1901 ...	31	7·2
1890	31	6·5	1902 ...	33	5·8
1891	31·5	6·6	1903 ...	*30	5·5
1892	26	9·7	1904 ...	26·5	10·4
1893	*26	9·0	1905 ...	—	4·2
1894	30·5	6·9			
1895	*26	7·9	Mean ...	30·0	7·8

* Anomalous years.

The obvious general conclusion to be drawn from this table may be briefly stated; disregarding for a moment the figures marked with an asterisk, the yield of wheat goes up as the autumn rainfall goes down, and *vice versâ*.

† Reprinted from *The Times* of 7th February, 1905.

But the relation indicated is much more specific than a mere general statement would imply. It may be put into a more precise form, as follows:—With certain exceptions every inch of autumn rainfall involves a diminution of the yield of wheat for the following year by a bushel and a quarter per acre. It may be premised that the extreme variation of yield was from 26 bushels in 1892, 1893, and 1895, to 35 bushels in 1898. If the yield be computed from the autumn rainfall by subtracting from the *datum* of 39·5 bushels per acre a bushel and a quarter for every inch of autumn rainfall, the "computed yield" obtained in this way shows an astonishing agreement with the actual yield given in the official returns.

In seven years out of the twenty-one the agreement is within half a bushel. But perhaps the general accuracy of the relationship is more strikingly manifest if the years when the calculation fails most signally to give the yield are considered. In seven of the years the actual yield differed from the computed yield by as much as 2·5 bushels or more, on the one side or the other. These are the years marked with an asterisk in the table. Two of the seven years were 1888 and 1903, when the crops were flooded by summer rains amounting to upwards of 10 in., and the yield fell below the computed value by 2·5 bushels in each case. The two exceptional years 1887 and 1899, when the crops exceeded the computed yield by 2·5 and 3 bushels respectively, are very interesting, for, although the autumn rainfall came up to the average as regards amount, it was so irregularly distributed that there were eight weeks out of the thirteen in the one case, and ten weeks in the other, when the rainfall was less than the 20 years' average, the amount for the quarter being brought up to the average by exaggerated rainfall in a few weeks. These might, therefore, be called dry autumns from a certain point of view, in spite of their having the average total rainfall, and the yield corresponds with the results for dry autumns rather than one with average rainfall. The two consecutive years 1895 and 1896 are also interesting; 1895 is memorable as the year of the extremely cold February, a truly anomalous year. Its yield of wheat was 3·5 bushels below the computed amount, but, strange to relate, the following year, which had in addition the advantage of a very dry winter, gave a yield above the computed return by 4·5 bushels per acre, as though the unused productive power of 1895 had not been lost in consequence of the exceptional cold, but stored. The two years taken together would agree admirably with the rule. The remaining exceptional year is 1893, a year of phenomenal drought.

Thus every year when the difference between the computed and actual yield is more than two bushels is otherwise conspicuously anomalous, except the years 1887 and 1899, and for those years the divergencies have been already, to some extent, explained. In the remaining seven years the computed yield differs from the actual yield by an amount between half a bushel and two bushels. An examination of the details of the statistics does not diminish the evidence of correspondence between the two sets of figures, but we need not consider the details here.

Various reasons may be given for regarding the autumn rainfall as likely to influence the yield of wheat; the washing of nitrates from the soil by the rain or the postponement of sowing to the spring on account of the wet are, no doubt, effective, but that all causes should combine to make the dryness

of autumn the dominant factor in determining the yield, as it clearly is, is very remarkable.

The averages both of yield and of rainfall are taken over large areas ; the figures are, in fact, the only ones immediately available for the purpose of such a comparison in the returns of the Board of Agriculture and the Meteorological Office respectively. What modification the induction would suffer if the inquiry were to be pursued for separate districts or individual fields has yet to be determined.

In the meantime the relationship clearly indicates a clue to such a phenomena as the deficiency of yield in 1904, after the favourable seasons of that year, in the excessive autumn rainfall of 1903; and it is sufficiently remarkable that when I first computed the yields on the principle of deducting from 39·5 a bushel and a quarter for each inch of autumn rainfall, and extended the calculation to the years 1904 and 1905, without knowing at the time the wheat yield of either year, the computed yield for 1904, 26·5 bushels per acre, was subsequently found to agree with the actual yield, which is entered at 26·52 bushels in the official returns. This agreement at once raises the interesting speculation whether the exceptionally large yield of 34·5 bushels per acre for 1905, computed from the small autumn rainfall of 1904, will be borne out to the same degree of accuracy. At any rate, it seems clear that in the absence of some extraordinary abnormality of the seasons between now and next September the yield of wheat for England must be unusually large.

ROYAL METEOROLOGICAL SOCIETY.

THE annual general meeting of this Society was held on Wednesday evening, January 18th, at the Institution of Civil Engineers, Great George Street, Westminster, Captain D. Wilson-Barker, President, in the chair.

Mr. F. C. Bayard read the Report of the Council, in which reference was made to the honour which H.R.H. the Prince of Wales had conferred on the Society by consenting to become its Patron. The work in connection with the exploration of the upper atmosphere had been continued. During the summer the Admiralty placed H.M.S. *Seahorse* at the disposal of the Kite Committee for the purpose of carrying on the kite observations off Crinan, under the direction of Mr. Dines. The average height attained by the kites was about one mile. The Society's Howard Silver Medal, annually awarded to the cadets of H.M.S. *Worcester*, had been gained by Cadet E. J. A. Lawson for the best essay on "The Barometric Conditions over the Oceans."

The Report having been adopted, votes of thanks were passed to the Council for their services during the past year, and also to the President and Council of the Institution of Civil Engineers for giving the use of the rooms of the Institution for the meetings.

The President then delivered an address on "The Connection of Meteorology with other Sciences." He said that Meteorology and

Astronomy were doubtless the first of the sciences to attract the attention of men; which of the two exerts most influence in the well-being of humanity is a matter dependent on one's position on the globe. In many regions people are but slightly affected by the weather, while the heavenly bodies, particularly the sun, exert an enormous influence on human life. Everywhere in Nature we find the effects of meteorological agencies. After speaking upon the effects of evaporation, winds, rain, ice, snow, and pointing out the influence of weather on animal life, vegetation, health, &c., Captain Wilson-Barker said that Meteorology is a science deserving more attention than it receives. He thought it ought to be recognised as a preliminary to the studies of geography, geology, and kindred subjects; and he was of opinion that meteorological observatories might very well be fitted up in schools and pupils taught to observe. This could be done at small cost of time or money. The tendency at present is to particularize in all scientific work, but the true path to progress lies in keeping a comprehensive outlook on the whole field of investigation. It is to be regretted that official help and encouragement is so deficient in this country. The difficult and baffling nature of meteorological problems should but serve as an incentive to their elucidation. The persistent observer gains much, not only in knowledge of the subject, but in the habits of close and accurate investigation which he insensibly acquires; and all workers in this field learn to appreciate the difficulties which confront their fellow-labourers and to recognise the value of what has been done by the meteorological organizations of the world.

On the motion of Dr. H. R. Mill, seconded by Mr. R. Inwards, a hearty vote of thanks was accorded to Captain Wilson-Barker for his services as President during the past year, during wnich he had done much to continue the usefulness and uphold the dignity of the Society, and also for his Address.

The following gentlemen were elected the Officers and Council :—

President—Mr. Richard Bentley. *Vice-Presidents*—Mr. F. Druce, Mr. J. Hopkinson, Mr. H. Mellish, and Captain D. Wilson-Barker. *Treasurer*—Dr. C. Theodore Williams. *Secretaries*—Mr. F. Campbell Bayard and Dr. H. R. Mill. *Foreign Secretary*—Dr. R. H. Scott, F.R.S. *Council*—Captain W. F. Caborne, C.B., Mr. R. H. Curtis, Dr. H. N. Dickson, Mr. W. H. Dines. Mr. W. Ellis, F.R.S., Capt. M. W. C. Hepworth, C.B., Mr. R. Inwards, Mr. Baldwin Latham, Mr. E. Mawley, Sir J. W. Moore, M.D., Dr. W. N. Shaw, F.R.S., and Mr. C. T. R. Wilson, F.R.S.

The Annual General Meeting was preceded by a brief Ordinary Meeting, at which the following gentlemen were elected Fellows :—Mr. P. A. Cunningham, Mr. C. C. James, M.Inst.C.E., Dr. J. Arnallt Jones, Mr. J. Owen Jones, Mr. C. J. Thompson, Dr. G. T. Walker, F.R.S., and Mr. E. F. White, F.R.A.S.

METEOROLOGICAL NEWS AND NOTES.

THE METEOROLOGICAL OFFICE is to be congratulated on the extremely important relationship worked out by Dr. Shaw between the autumnal rainfall and the following wheat harvest, which we print on another page. Mr. A. D. Hall, of the Rothamsted experimental farm, points out that the winter rainfall also is an important factor, and it is we believe not too much to hope that many farmers will be induced to keep rain gauges and study for themselves the applicability to special cases of the general results.

MR. R. C. MOSSMAN, after remaining for two complete years at the meteorological station established by the Scottish Antarctic Expedition in the South Orkney Islands, has now completed his work and reached Buenos Aires on February 8th on his way home. The results he has secured cannot fail to be profoundly interesting.

PROFESSOR H. H. HILDEBRANDSSON'S remarkable discussion of the international cloud observations, of which an abstract appeared in this Magazine for 1903 (vol. **38**, p. 122), has been translated in full by Mr. R. G. K. Lempfert and published with the original plates in the *Quarterly Journal* of the Royal Meteorological Society. We believe that the expense of the translation and the production of the plates was borne by the Meteorological Council, a proof of that cordial co-operation between the different Meteorological organizations which it is always a pleasure to recognize.

DUST FALLS may be expected to occur at any time within the next two months, and our readers should be on the watch for any unusual haze or the appearance of coloured dust on trees or windows. For the last three or four years there has been a widespread fall of African dust in Europe at some date between January and March.

OUR RAINFALL AVERAGES.

THE proper use of an average is to serve as a standard which makes it easy to compare one month or year with another, and for this purpose it is well to take the average of a period so long that the addition of the wettest year or of the driest year would not greatly disturb the value. For instance, if the average rainfall of 10 years happened to be 30·00 in., the addition of a very wet year, say, with 45·00 in., would alter the average to 31·36; but if the average of 30 years happened to be 30·00 in., the addition of a year with 45·00 in. would alter the average to 30·48 only, and if the average of 100 years had given the value 30·00 the addition of the wet year supposed would merely alter it to 30·15. It is impossible to obtain averages so long as a century, and undesirable to use averages so short as ten years, but the average of 30 years is a useful figure to employ. While the average of one period of 30 years is very like the average of another period of the same duration, it is satisfactory

in comparing the records of a number of stations to refer them to their average for one and the same period. In *British Rainfall* the average for the 30 years 1870–99 has been used for some time, and it is convenient to have the same standard in these pages also. The chief difficulty in the way of doing so is that a good many of the stations quoted in our tables were not established in 1870; but in most cases this difficulty can be overcome. It will not do to piece together the records at two different stations, even though these are not very far apart, for every place has its own rainfall due to a number of local conditions. The way in which the long-period average is calculated for a station with a short record is by comparison with a station not very far away, or perhaps with several stations which have been in action for the longer period. Thus we will suppose that a station which we may call A was established in 1895, and another which we may call B, a few miles distant, was established in 1870. To find the average annual rainfall at A for the period 1870–99 we first deal with B. Supposing that the arithmetical average for the 30 years 1870–99 at B is 35·00 in. and the average for the 10 years 1895–1904 at the same station is 32·50 in., we find that if 32·50 is expressed as 100, 35·00 would be expressed as 107·7; in other words, the average of the shorter period must be increased by 7·7 per cent. in order to make it equal to the average of the longer period. Since the stations A and B are near together, it is safe to assume that, though their actual rainfalls may differ slightly, the same ratio will hold good for both stations; so that, supposing the 10 years' average at A was 32·75 in., we have only to increase that figure by 7·7 per cent. in order to yield the number 35·27, which corresponds to the 30 years' average required.

The average monthly falls are not so easily calculated. The reason is that while it is very rare for the wettest year to be more than 50 per cent. above the average or for the driest year to be more than 30 per cent. below the average, the wettest month may be 300 per cent. or more above the average, and the driest may be 100 per cent. below the average—in other words, the month may be quite without rain. In view of this great variability, 30 years is too short a time by which to determine the average distribution of the mean annual rainfall throughout the months of a year. If, for instance, half a dozen wet Januaries occurred in consecutive years once in a century, the 30 years' average containing that run of wet Januaries would give far too high a value for that month, and any period of 30 years not containing the group would give too low a value. Though we cannot eliminate this uncertainty at present, we can take comfort in the thought that the monthly distribution of rainfall in 30 years is much more than three times as satisfactory as the monthly distribution in ten years.

The table on p. 16 is calculated on the 30 years' means 1870–99, wherever it was possible to do so; and thus it is a distinct improvement on former tables of the kind.

RAINFALL AND TEMPERATURE, JANUARY, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-9.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches.	inches.	in.								
I.	London (Camden Square) ...	1·34	— ·55	·60	16	8	54·3	6	21·2	16	17	24
II.	Tenterden ...	1·15	— 1·21	·59	16	12	53·5	6, 7	15·0	2	15	24
,,	Hartley Wintney ...	·72	— 1·98	·36	16	9	57·0	8	19·0	2, 27	21	23
III.	Hitchin ...	1·13	— ·68	·55	16	9	52·0	6	20·0	15	17	...
,,	Winslow (Addington) ...	·84	— 1·21	·19	16	12	53·0	6	18·0	19, 27	19	25
IV.	Bury St. Edmunds (Westley)	1·19	— ·51	·45	16	10	51·0	6	20·0	2	20	...
,,	Brundall ...	·93	— ·74	·47	16	15	52·0	6	21·4	2	17	24
V.	Alderbury ...	·61	— 2·06	·25	16	8	52·0	29	19·0	27	28	...
,,	Winterborne Steepleton ...	1·42	— 2·48	·85	16	15	54·9	7	20·0	27	19	21
,,	Torquay (Cary Green) ...	1·42	— 1·77	·82	16	10	54·8	7	29·4	27	3	15
,,	Polapit Tamar [Launceston]	2·44	— 1·43	·54	16	19	52·1	8	18·2	27	11	13
,,	Bath ...	·61	— 1·91	·17	4	12	54·2	7	19·0	27	17	25
VI.	Stroud (Upfield) ...	·68	— 1·78	·22	8	9	52·0	6, 7	23·0	18	20	...
,,	Church Stretton (Woolstaston)	·70	— 2·11	·16	8	15	52·0	6	20·0	17	16	...
,,	Bromsgrove (Stoke Reformatory)	·77	— 1·14	·28	8	7	51·0	6	15·0	17	20	...
VII.	Boston ...	·81	— ·78	·24	9	11	50·0	9	22·0	19	19	...
,,	Worksop (Hodsock Priory).	·53	— 1·21	·17	16	10	52·9	6	13·4	20	17	24
,,	Derby (Midland Railway)...	·80	— 1·15	·21	16	15	51·0	6, 7	17·0	18, 19	18	...
VIII.	Bolton (The Park) ...	2·23	— 1·15	·38	5	20	49·7	9	22·9	17	13	20
IX.	Wetherby (Ribston Hall) ...	·99	— ·90	·46	11	8	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	3·35	— 2·98	1·00	11	20	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	·62	— 1·18	·15	11	12	54·0	6	21·0	20	15	22
X.	Newcastle (Town Moor) ...	·44	— 1·52	·12	23	10	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	9·15	— 5·56	1·32	11	20	50·5	6	24·7	17	7	...
XI.	Cardiff (Ely) ...	1·64	— 2·21	·44	16	16	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	2·70	— 2·43	·53	16	16	52·6	6	24·4	27	8	14
,,	Aberystwith (Gogerddan)..	3·05	— ·82	·83	8	13	55·0	5	20·0	19	11	...
,,	Llandudno ...	2·20	— ·37	·41	5	16	53·0	8	25·5	16	4	...
XII.	Cargen [Dumfries] ...	2·33	— 2·21	·61	17	13	52·0	28	25·0	22, 26	13	...
,,	Lilliesleaf (Riddell) ...	1·15	— 1·45	·40	11	14	52·0	6	17·0	16	16	21
XIII.	Edinburgh (Royal Observy.)	·76	...	·27	11	11	50·4	6	25·6	17	8	21
XIV.	Colmonell ...	2·98	— 1·54	·47	4	18	49·0	3,5,28	28·0	25	7	...
XV.	Tighnabruaich ...	5·34	— ·52	·98	17	24	47·0	29	27·0	16, 25	15	15
,,	Mull (Quinish) ...	4·29	— 1·56	·61	8	24	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	·35	— 1·75	·10	3	11	55·9	6	27·0	19	11	...
XVII.	Braemar ...	1·61	— 1·30	·26	7	16	49·2	30	19·2	19	16	...
,,	Aberdeen (Cranford) ...	·73	— 1·59	·20	16	13	54·0	28a	25·0	18	13	...
,,	Cawdor (Budgate) ...	2·05	— ·09	·34	11	15	...	...	...	...	...	...
XVIII.	Invergarry ...	7·55	+ ·92	1·30	8	15	...	...	...	...	...	...
,,	Bendamph ...	8·51	— ·24	1·02	8	24	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	3·38	+ ·76	·65	11	14	54·5	8	26·5	10, 26	6	...
,,	Castletown ...	3·60	...	·63	31	22	52·0	30	26·0	25, 26	16	...
XX.	Killarney ...	4·52	— 2·05	·86	15	18	53·5	15	32·0	18, 26	2	...
,,	Waterford (Brook Lodge)...	2·73	— 1·33	·71	16	18	53·0	5, 6	24·6	26	8	...
,,	Broadford (Hurdlestown) ...	2·56	— ·42	·59	14	18	52·0	5, 10	29·0	25	6	...
XXI.	Carlow (Browne's Hill) ...	2·40	— ·75	·71	16	16	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·90	— ·26	·59	16	14	53·9	6, 8	29·9	26	2	9
XXII.	Ballinasloe ...	2·26	— 1·23	·47	16	22	60·0	1, 30	25·0	13, 26	9	...
,,	Clifden (Kylemore House)..	6·08	— 1·78	·81	14	18	...	...	...	...	...	...
XXIII.	Seaforde ...	1·85	— 1·78	·59	16	13	52·0	5	26·0	18	4	11
,,	Londonderry (Creggan Res.)	3·08	— ·48	·49	5	24	...	...	...	...	...	...
,,	*Omagh (Edenfel)* ...	3·30	— ·04	·52	16	22	51·0	5	28·0	25	6	16

+ *Shows* that the fall was above the average; — that it was below it. a—and 29 30.

SUPPLEMENTARY RAINFALL, JANUARY, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·57	XI.	New Radnor, Ednol	1·70
,,	Ramsgate, West Cliff	·94	,,	Rhayader, Nantgwillt	3·71
,,	Hailsham	1·30	,,	Lake Vyrnwy	2·73
,,	Crowborough	1·68	,,	Ruthin, Plâs Drâw	·99
,,	Osborne	1·02	,,	Criccieth, Talarvor	1·89
,,	Emsworth, Redlands	1·16	,,	Anglesey, Lligwy	1·63
,,	Alton, Ashdell	·97	,,	Douglas, Woodville	1·76
,,	Newbury, Welford Park	·67	XII.	Stoneykirk, Ardwell House	1·47
III.	Harrow Weald	1·35	,,	Dalry, Old Garroch	4·93
,,	Oxford, Magdalen College	·74	,,	Langholm, Drove Road	2·66
,,	Banbury, Bloxham	·78	,,	Moniaive, Maxwelton House	2·73
,,	Pitsford, Sedgebrook	·86	XIII.	N. Esk Reservoir [Penicuick]	2·05
,,	Huntingdon, Brampton	1·11	XIV.	Maybole, Knockdon Farm	2·94
,,	Wisbech, Bank House	·98	,,	Glasgow, Queen's Park	1·87
IV.	Southend	·85	,,	Campbeltown, Redknowe	4·04
,,	Colchester, Lexden	·81	XV.	Inveraray, Newtown	7·12
,,	Saffron Waldon, Newport	1·26	,,	Ballachulish House	9·44
,,	Rendlesham Hall	·96	,,	Islay, Eallabus	4·53
,,	Swaffham	1·03	XVI.	Dollar	1·55
,,	Blakeney	·82	,,	Loch Leven Sluices	1·40
V.	Bishop's Cannings	·70	,,	Balquhidder, Stronvar	5·43
,,	Ashburton, Druid House	2·58	,,	Coupar Angus Station	·44
,,	Okehampton, Oaklands	2·74	,,	Blair Atholl	1·37
,,	Hartland Abbey	1·60	,,	Montrose, Sunnyside	·72
,,	Lynmouth, Rock House	2·08	XVII.	Alford, Lynturk Manse	·92
,,	Probus, Lamellyn	2·78	,,	Keith	1·57
,,	Wellington, The Avenue	·90	XVIII.	N. Uist, Lochmaddy	3·02
,,	North Cadbury Rectory	·91	,,	Aviemore, Alvey Manse	1·84
VI.	Clifton, Pembroke Road	·68	,,	Loch Ness, Drumnadrochit	3·12
,,	Moreton-in-Marsh, Longboro'	1·07	,,	Glencarron Lodge	13·39
,,	Ross, The Graig	1·23	,,	Fearn, Lower Pitkerrie	1·61
,,	Shifnal, Hatton Grange	·68	XIX.	Invershin	4·55
,,	Wem Rectory	·72	,,	Altnaharra	6·06
,,	Cheadle, The Heath House	1·41	,,	Bettyhill	4·05
,,	Coventry, Kingswood	·84	,,	Watten	2·33
VII.	Market Overton	·94	XX.	Cork, Wellesley Terrace	3·46
,,	Market Rasen	·63	,,	Darrynane Abbey	4·22
,,	Bawtry, Hesley Hall	·47	,,	Glenam [Clonmel]	3·22
VIII.	Neston, Hinderton	·92	,,	Ballingarry, Gurteen	2·21
,,	Southport, Hesketh Park	1·65	,,	Miltown Malbay	3·31
,,	Chatburn, Middlewood	2·49	XXI.	Gorey, Courtown House	1·20
,,	Cartmell, Flookburgh	2·20	,,	Moynalty, Westland	1·81
IX.	Langsett Moor, Up. Midhope	2·27	,,	Athlone, Twyford	2·05
,,	Scalby, Silverdale	·80	,,	Mullingar, Belvedere	2·40
,,	Ingleby Greenhow	·51	XXII.	Woodlawn	2·79
,,	Middleton, Mickleton	1·28	,,	Westport, Murrisk Abbey	4·57
X.	Beltingham	·88	,,	Crossmolina, Enniscoe	4·70
,,	Font Reservoir, Fallowlees	·99	,,	Collooney, Markree Obsy	3·41
,,	Ilderton, Lilburn Cottage	·59	XXIII.	Enniskillen, Portora	2·27
,,	Keswick, The Bank	3·00	,,	Warrenpoint	2·14
XI.	Llanfrechfa Grange	1·42	,,	Banbridge, Milltown	1·97
,,	Treherbert, Tyn-y-waun	3·36	,,	Belfast, Springfield	2·61
,,	Carmarthen, Friary	1·84	,,	Bushmills, Dundarave	2·74
,,	Castle Malgwyn	2·72	,,	Stewartstown	2·39
,,	Plynlimon	8·95	,,	Killybegs	3·28
,,	Tallyllyn	1·40	,,	Horn Head	3·72

METEOROLOGICAL NOTES ON JANUARY, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The first 10 days were inclement with little sunshine, but no great amount of rain. From the 10th fine dry weather set in, changing to severe frost which culminated on 16th. On that day the temp. did not rise above 23° until the evening, when there was a driving shower of icy sleet followed by glazed frost and heavy R. The latter part of the month was fine, and beautiful sunny weather accompanied the remarkable barometric conditions of the last week (see p. 2). Duration of sunshine 38·7 hours,* and of R 29·1 hours. Mean temp. 38·0, or 0·1 below the average.

TENTERDEN.—Showery and dull till 11th. Much sleet and R on 16th, making the roads sheets of ice. Then dry and cold till 30th, but with no severe frost. Duration of sunshine 78·3 hours.† Violent N.W. gale on 6th and 7th.

CROWBOROUGH.—Cold but yet genial, considerable bright sunshine and R below the average. Frost on 14 nights, the min. temp. falling to 17°·8 on 2nd. Mean temp. 37°·3.

HARTLEY WINTNEY.—A black January, the chief features being dryness and absence of wind. Hazy windless atmosphere from 21st to 25th. The last week was sunny. Ozone on 18 days; mean 4·1.

HITCHIN.—The bar. readings were: 27th, 30·85 in.; 28th, 30·85 in.; and 29th, 30·90 in. These readings are unprecedented since October 29th, 1849.

BURY ST. EDMUNDS.—Violent barometric oscillations, the pressure ranging from 29·15 in. on 17th to 30·95 in. on 27th. Very fine weather from 17th. Westerly winds on 22 days.

BRUNDALL.—Fine with seasonable frosts, but litte S. Mean temp. 0°·4 above the average, constituting the eighth successive January with mean temp. above the average.

TORQUAY.—Duration of sunshine 87·3 hours,* or 25·9 hours above the average. Mean temp. 42°·8, or 0°·5 above the average. Mean amount of ozone 4·6.; max. 8·0 on 15th with S.E. wind; min. 2·0 on 8 days.

WELLINGTON.—Exceedingly dry, the R being about one-third of the average. The temp. was very equable after 8th, not varying much from the normal. Violent E.S.E. gale on 14th. On 28th the bar. rose to slightly above 31·00 in.

NORTH CADBURY.—Altogether pleasant and not unseasonable, with the smallest R and least cloud in nine years. Cool but not cold, with many but very slight frosts. The first half was windy, the second very calm.

CLIFTON.—The driest January in 49 years, with the single exception of 1896 when only ·60 in. of R fell. Frost from 15th to 28th, and very fine weather with cloudless skies from 25th to 29th. Bar. on 29th, 30·96 in., the highest reading in 55 years. About one and a half inches of S fell on 16th.

ROSS.—Warm from 2nd to 12th and from 28th to 31st, but thick S covering the ground for 12 days from 15th. This was the eleventh month in succession with R below the average, and on 350 days ending on February 1st only 17·41 in. had fallen.

WORKSOP.—The first fortnight was mild, followed by a fortnight's frost. Bitterly cold wind on 16th with S in evening. Only 1880 and 1898 had a smaller January R in the past 29 years.

BOLTON.—Bar. much above the average, the reading of 30·924 on 28th having been exceeded only once since 1886. Temp. fairly normal. Duration of sunshine 9 hours* below the average. Predominant winds westerly. Mean amount of ozone 2·3.

SOUTHPORT.—Decidedly dry, with very high bar., but nevertheless stormy generally. Mean temp. 0°·4 above the average. Duration of sunshine 1 hour* below the average. R 1·04 in. below the average. Underground water level *unprecedentedly* low for January. Total depth of S 1·5 in.

NEWCASTLE-ON-TYNE.—The smallest R in January since observations were commenced in 1868.

HAVERFORDWEST.—Stormy and wet till 17th, and from 13th to 17th one continuous gale. Cold and changeable from 17th to the end. Unusually high bar. from 26th to 29th, reaching 31·053 at 11.30 a.m. on 28th, the highest reading during 56 years. Duration of sunshine 66·2 hours.*

DOUGLAS.—The first three weeks presented an almost unbroken series of gales, with showery and very cold weather. From 16th to 18th a violent E. gale blew for some 50 hours, with a heavy fall of S. From 24th to 30th was bright, calm and mild. R the least, except 1880 and 1881, in any January recorded.

SCOTLAND.

LANGHOLM.—R 2·02 in. below the average of 29 years. Gales were frequent and the temp. fluctuated a great deal.

COLMONELL.—Mostly strong winds from 6th to 16th, especially from 13th to 16th. Light S on 9th, 15th and 16th. T on 12th.

MULL, QUINISH.—Stormy weather, beginning on 5th, culminated in a hurricane from E. to S.E. on 16th, which did considerable damage. The month otherwise was fine and very mild.

COUPAR ANGUS.—R 1·83 in. below the average. Mean temp. 36°·2, or about one degree above the average. Generally open and mild, with no extremely low temp.

ABERDEEN.—Very mild, with little frost or S, but many gales, one of which blew for 50 hours from S.W.

DRUMNADROCHIT.—Characterized by a series of severe storms of wind, high bar. pressure and generally favourable weather. R ·63 in., and rainy days 16, below the average of 19 years. Mavis and blackbird first heard on 29th.

WATTEN.—Cloudy, fresh and open. A series of storms of wind accompanied by R at the beginning and end.

CASTLETOWN.—The first 12 days were cold, wet and cloudy, with westerly winds and N.W. gale on 6th. From 13th to 23rd was dry and clear with strong S. and S.E. winds. Thence to the end was changeable. Practically no S fell.

IRELAND.

DARRYNANE ABBEY.—Fairly dry, the R being 10·5 per cent. below the average of 25 years. Very mild, with several quite springlike days towards the end.

DUBLIN.—Open, but dull, with W., S.W., and S.S.E. winds. Severe storm of R and sleet on 15th and 16th. Remarkable anticyclone from 25th to 28th, the bar. rising to 30·999 in. at 9 p.m. on 28th at Fitzwilliam Square, and to 31·007 in. at Trinity College.

MILTOWN MALBAY.—Cold and generally wet, though the R fell in small quantities. The weather was stormy, and for many weeks the sun was not seen until it burst out on the 25th.

BELFAST.—A satisfactory month, with R ·86 in. below the average. The S did not stay long.

OMAGH.—The first half was unsettled and inclement, culminating in a blizzard of remarkable severity on 16th, but thence to the end, with a gradually rising bar. (reaching 30·7 in. on 27th), the month was fine and generally mild, the min. temp. only once reaching 28°. This formed the tenth mild January in succession.

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* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, August, 1904.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	91·0	4	44·3	21	73·6	52·7	55·1	79	135·9	37·7	1·59	9	4·4
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	81·2	17	42·5	25	61·3	48·9	49·8	82	...	...	4·64	11	6·1
Durban, Natal	83·9	30	49·7	13	76·4	55·5	...	...	138·3	...	·18	3	1·8
Johannesburg	76·9	30	32·5	23	65·5	44·3	34·2	52	...	32·0	·02	1	4·4
Mauritius	78·5	15	55·1	19	75·5	59·8	59·2	76	139·3	45·8	·98	15	5·7
Calcutta	92·4	18	76·9	6	88·8	79·1	77·8	84	157·0	74·8	10·11	16	8·3
Bombay	86·8	1	75·0	25	84·8	77·6	75·3	82	137·9	72·8	5·72	23	8·4
Madras	101·4	28	75·3	4	96·0	78·3	71·2	67	146·9	74·1	2·55	7	5·8
Kodaikanal	67·2	12	49·0	22	64·2	51·6	51·3	81	141·6	35·5	2·53	14	6·9
Colombo, Ceylon	87·4	29	75·8	24	85·2	77·4	73·3	80	150·0	71·2	·36	4	6·0
Hongkong	90·0	18	72·9	11	86·0	77·2	74·9	83	147·2	...	27·64	16	6·8
Melbourne	62·8	22	34·0	26	69·1	33·5	42·1	75	125·3	27·0	3·28	13	7·1
Adelaide	68·4	22	38·1	16	60·9	45·6	44·0	74	125·8	32·6	1·98	16	6·5
Coolgardie	76·0	24	35·6	8	65·3	42·3	42·1	64	140·6	27·6	·24	5	3·6
Sydney	70·5	13	42·0	2	62·1	47·2	44·2	77	104·5	33·9	1·33	17	4·3
Wellington	59·8	14	33·1	3	54·3	42·2	39·6	73	108·0	30·0	3·49	14	5·2
Auckland	61·0	27	37·0	5	56·3	45·6	44·0	78	118·0	32·0	3·57	18	5·7
Jamaica, Negril Point	89·9	5	69·3	1	87·0	72·0	73·4	80	...	...	4·07	12	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	..	...
Grenada	87·4	10	70·0	18	84·1	74·2	70·4	76	152·0	...	10·78	27	2·7
Toronto	84·2	1	45·6	6	75·3	54·3	56·4	77	116·5	40·2	4·56	10	4·5
Fredericton	85·7	1	38·5	30	74·2	50·6	50·8	59	...	...	3·85	11	4·7
Winnipeg	84·0	26	35·5	29	72·5	49·6	...	...	...	...	1·62	10	4·9
Victoria, B.C.	82·2	4	45·9	11	66·8	51·3	...	...	...	...	·50	2	2·2
Dawson	80·0	9	30·0	26	64·7	42·2	...	...	...	...	1·66	9	4·8

Mauritius.—Mean temp. of air 0°·8, dew point 0°·3, and rainfall 2·18 in., below averages. Mean hourly velocity of wind 9·8 miles, or 2·5 miles below average, prevailing direction E. by S.

Madras.—Bright sunshine 163·8 hours, or 42·3 per cent. of possible. R 2·00 in. below average.

Kodaikanal.—Bright sunshine 158 hours.

Colombo.—Mean temp. of air 81°·0, or 0°·2 above, of dew point 0°·1 above, and R 3·41 in. below, averages. Mean hourly velocity of wind 8·9 miles; prevailing direction S.W.

Hongkong.—Mean temp. of air 80°·8. Sunshine 172·6 hours. Mean hourly velocity of wind 13·2 miles; direction E. by S.

Adelaide.—Mean temp. of air 0°·7 below and R ·35 in. below, averages.

Sydney.—Mean temp. of air 0°·1 below, R 1·89 in. below, and humidity 2·5 above, averages.

Wellington.—Mean temp. of air 0°·2 above, and R 1·45 in. below, averages.

Auckland.—Mean temp. of air 2°·0 below the average, and R ·75 in. below the average of previous 36 years.

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THE RAINFALL OF THE SIX MONTHS,

September, 1904—February, 1905.

It very rarely happens that the general rainfall of the country remains below the average every month for six consecutive months; and although there is nothing unprecedented in the circumstance it is sufficiently interesting to induce us to summarise the condition of things in a special table, setting forth the monthly rainfall since September with the percentage of the average for as many stations as could be compressed into a page by the ingenuity of the printer.

For each of the 55 stations employed the average rainfall of the thirty years 1870–99 is known or has been computed. That is the average used in the following tables, and it is probably within 2 per cent. of the average of a much longer period, say 50 years.

To avoid confusion, the word average is used with regard to time only, the expression "general rainfall" being employed to convey a similar idea with regard to space. Thus the general rainfall of England and Wales for any period means the mean depth of rain which has fallen in that period over the whole surface. The fifty-five stations the records of which are employed are so uniformly distributed over the country that it is safe to generalise from them as to the general conditions.

It is obvious that a deficiency of one inch of rain in a place like London where the average annual fall is 25 inches is a much more serious matter than a deficiency of an inch at a station, say in Wales, with an average annual fall of 100 inches; in the former case the inch means 4 per cent., in the latter only 1 per cent. of the annual fall. Hence, to facilitate comparison the rainfall for each station is expressed not only in inches but also in ratios, the average for the month or period being indicated in each case by 100. Thus in the tables 50 represents 50 per cent. or one-half of the average fall, 75 represents three-quarters of the average fall, and so on; figures above 100 indicate falls above the average.

When the figures quoted in Table I. are set down on a map, the apparent irregularity of the deficiencies disappears, and the distribution is seen to be simple and easy to grasp. The rainfall for the six months reached and even slightly exceeded the average over a narrow strip in the west of Scotland from the west end of the Caledonian Canal to the Firth of Clyde. The rainfall amounted to at least 75 per cent. or three-quarters of the average over all Scotland north of Inverness and west of the meridian of 4° W., and also in the north-western half of Ireland, in the English Lake district, and in a small area on the west coast of Wales. All the rest of the British Isles had less than three-quarters of the usual fall.

In two large areas the rainfall for the six months fell short of 50 per cent. of the average. The first of these areas with less than half the usual fall is situated in the south-east of Scotland, including practically the whole of the counties of Fife, Kinross, Haddington and Berwick, as well as most of Forfar and Midlothian, and parts of Perth, Peebles, Selkirk and Roxburgh. The gathering grounds for the water supply of Edinburgh and Dundee lie in this area of great deficiency.

The second and larger district in which less than half the average amount of rain has fallen since September 1st, 1904, occupies the Midlands, extending from Hull in the north-east to beyond Hereford and Bath in the south-west. It includes the whole valley of the Trent, the Warwickshire Avon and the upper Thames. The whole of the counties of Derby, Nottingham, Leicester, Stafford and Warwick appear to lie within the dry area, which also includes a little of the south of Yorkshire and portions of Lincoln, Rutland, Northampton, Shropshire, Hereford, Worcester, Oxford, Gloucester, Wiltshire and Somerset. It is worthy of notice that both the dry areas have normally a low rainfall, so that the total amount of rain which fell there is extremely small. Hodsock Priory, near Worksop, is the most remarkable instance, the falls and percentages at that station having been as follows :—

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Six months
Inches	1·21	·32	·98	1·20	·53	·73	4·97
Per cent. of average..	56	12	47	59	30	46	40

It is, of course, well-known to our readers that the longer the period under consideration, the smaller is the deviation from the average which is likely to occur. Thus a week with less than 1 per cent. of the average rainfall is common, but a month with only 1 per cent. of the average rainfall is excessively rare, and for the general rainfall of the British Isles the driest year on record showed 77 per cent. of the average.

Although the number of stations the records of which have been discussed is too small to allow one to treat detached portions of the United Kingdom with the same confidence as the whole, it is possible to compare at least the three kingdoms as shown in Table II.

TABLE II.—*Monthly Rainfall, Sept., 1904—Feb., 1905.*

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Six months.
England and Wales	67	40	64	89	47	57	60
Scotland	88	56	67	82	75	106	78
Ireland	99	59	73	76	78	69	75
British Isles	80	48	67	84	62	73	68

February was a wet month in the west and north of Scotland, and it was the only month in the six during which the general rainfall of any of the larger divisions touched the average, though in Ireland September came very near it. Leaving Ireland out of account, for the contrasts in rainfall in that island are as usual slight, we may divide Great Britain from north to south into a smaller western and a larger eastern division. A convenient line to take is the meridian of 4° W., which runs through the centre of the map, Caithness and the portion of Sutherland east of that line being reckoned with the western division. The result for monthly rainfall then appears :—

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Six months.
Western Division, 12 stations	101	64	81	90	85	114	88
Eastern Division, 31 stations	64	38	61	85	46	59	58

This shows that in the west there were only four consecutive months with any general deficiency, and that was so small as to be scarcely noticeable in such a wet region.

The much larger eastern division, containing most of Wales and the whole of England except Cornwall, only received as much as two-thirds of the average rainfall in one month out of the six, and had far less than half the average amount in October (which has normally the heaviest fall of any month in the year) and in January; the total deficiency for the six months amounting to as much as 42 per cent. of the average fall.

The necessity of economising water-supply had already made itself felt in several large towns within the dry area before the end of February. In several cases warnings had been issued to householders to economise the supply, and in some the supply had actually been shut off for a considerable part of the day. As the gathering grounds of most of the large towns supplied by gravitation lie in the area of considerably deficient rainfall, the effect of this exceptionally small autumn and winter rainfall cannot fail to be seriously felt as the year advances, even if the Spring months bring a normal fall sufficient for the needs of agriculture. The winter rainfall also is that on which deep wells depend for their supply, and water from underground sources may be deficient in summer unless the rainfall is so distributed as to keep the ground saturated. The first fortnight of March has shown a comparatively large rainfall over the whole country, and it is already apparent that the succession of continuously deficient months has been broken.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE DEFICIENCY OF RAINFALL.

THE deficiency of rainfall in this district seems so remarkable as to be worthy of note in your pages.

Since January 1st of the present year to date, the total precipitation has been but 1·46 inches, falling on 23 days, and I am given to understand that in some of the outlying country districts water is so scarce that it is being purchased in small quantities at high prices.

The weekly totals from Jan. 1st to Feb. 25th, 1905, are :—

Week ending.	Amount of Rain.	Week ending.	Amount of Rain.
Jan. 7th	·19 in.	Feb. 4th	·08 in.
,, 14th	·08 in.	,, 11th	·02 in.
,, 21st	·75 in.*	,, 18th	·08 in.
,, 28th	·03 in.	,, 25th	·22 in.
On January 29th...	·01 in.		
Total to 31st Jan...	1·06 in.	Total to Feb. 25th	·40 in.
		Total from Jan. 1st	1·46 in.

* This amount all fell on one day, viz. :—the 16th, leaving 0·31 in. as the total for the rest of the month.

If it had not been for the considerable fall on January 16th, the total precipitation for the *nine weeks* under consideration would have been only 0·71 in. !

D. W. HORNER.

Worthing, Feb. 25th, 1905.

I SHOULD be glad to hear if the following is of interest or use to you, as it is certainly curious.

Rainfall at Goring, 1905.

Jan.	2.....	·04 in.	Feb.	6.....	·04 in.
,,	4.....	·07 ,,	,,	7.....	·03 ,,
,,	5.....	·04 ,,	,,	18.....	·02 ,,
,,	6.....	·02 ,,	,,	25.....	·15 ,,
,,	8.....	·02 ,,	,,	26.....	·18 ,,
,,	17.....	·07 ,,	,,	28.....	·06 ,,
	Total ...	·26 ,,		Total ...	·48 ,,

Average for 2 months, 3·48 ; fall, ·74 ; deficit, 2·74. Following a very dry autumn this is serious. The poor on our hills have been hauling water for a long while, and as an example of the dryness, the leaves of the beech lie in drifts knee-deep in our woods. Someone had set these alight, and the flames spread over a considerable area before a strong N.E. wind last week.

C. GAMBIER PARRY, MAJOR.

Elmcroft, Goring, Oxfordshire, 1st March, 1905.

I SEND you the rainfall at Walton for the four wet months, October, November, December, and January, in periods of 10 years with averages for each. These figures strikingly emphasise the present abnormal dryness: the first, 1876: 15·49, compared with the last, 1904: 2·91, shows the variations of our climate strongly.

	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.
Oct.	2·28	2·54	2·07	·94	4·80	2·62	3·74	3·23	1·13	5.39
Nov.	3·44	1·84	2·07	1·11	1·54	2·10	2·60	2·09	·52	2·22
Dec.	6·03	2·24	1·38	1·32	3·28	2·44	1·65	·84	2·05	·53
Jan.	3·74	2·02	1·14	·56	·06	1·95	2·47	2·98	·93	3·79
	15·49	8·64	6·66	3·93	9·68	9·11	10·46	9·14	4·63	11·93

	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Oct.	4·16	2·32	·84	3·85	·61	2·83	5·42	1·54	3·86	2·95
Nov.	1·44	1·62	5·45	·77	2·65	1·86	·89	1·53	·76	2·15
Dec.	3·65	1·44	1·55	1·49	·51	3·11	·48	2·73	1·13	2·72
Jan.	2·24	·94	1·39	2·28	1·27	·91	1·21	1·41	3·80	·24
	11·49	6·32	9·23	8·39	5·04	8·71	8·00	7·21	9·55	8·06

	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Oct.	3·66	1·17	2·85	2·37	2·48	1·67	2·45	5·89	·30
Nov.	1·19	1·67	1·59	·55	1·64	2·92	1·43	1·04	·98
Dec.	1·84	1·77	2·01	2·37	2·48	3·57	1·11	·66	1·21
Jan.	2·50	·38	2·27	2·00	1·11	·89	1·18	1·73	·42
	9·19	4·99	8·72	7·29	7·71	9·05	6·17	9·32	2·91

10 years, 1876–1885	Average	8·97
10 years, 1886–1895	,,	8·20
9 years, 1896–1904	,,	7·26
29 years, 1876–1904	,,	8·17

EDWARD SIMPSON.

Walton Hall, Wakefield, 23rd Feb., 1905.

GREAT BAROMETRIC RANGE.

IN the February number of the Magazine there is much about the high barometer of January, 1905, but no reference is made to the low barometer of the same month, or to the extreme range of the barometer in the British Isles.

In the *Daily Weather Report* of 17th January, 1905, it was stated that "at Blacksod Point the mercury descended in the night to 27·99 in."

In the Magazine you write, "so far as we have been able to ascertain, the highest recorded was 31·097 inches at Falmouth Observatory."

This gives the great range of 3·107 in. for the British Isles in a single month.

W. E. MILNER.

Rose Cottage, Berkhamsted, 24th Feb., 1905.

REVIEWS.

Observations de la direction des nuages faites en Danemark, aux Færöe, en Islande et au Grönland, 1896-97. [Observations of cloud direction made in Denmark, the Færoes, Iceland and Greenland.] Copenhagen, 1904.

THIS report is published by the Meteorological Institute of Denmark, the work having been carried out in accordance with the programme of the International Meteorological Committee. The figures are stated without discussion.

Bericht über die Ergebnisse der Beobachtungen für das Liv-Estländische Regenstationennetz. 15-jährige Mittelwerte . . . für den Zeitraum 1886-1900, von PROF. DR. B. SRESNEWSKY. [Report on the results of the observations of the rainfall system of Livonia-Esthonia. 15-year means for the period 1886-1900.] Yuryeff [Dorpat], 1904. Size 10 × 7. Pp. 48. Maps.

THE rainfall statistics of the western Baltic province of Russia are set out in detail and embodied in a series of neatly constructed maps.

Report of the Meteorological Council for the year ending 31st March, 1904, to the President and Council of the Royal Society. London. Printed for H.M. Stationery Office. Size 9½ × 6. Pp. 204. Price 1s. 2d.

IF Mr. Mawley included the phenomena of official meteorological publications in his phenological report, he would have indicated the appearance of this annual by means of a very large negative quantity, for it has rarely, if ever in recent years, blossomed so early before. By our delay in noticing its arrival we have done it an injustice which we are anxious to repair by placing on record our high appreciation of the steady improvement in quality and arrangement, as well as date of issue of this very important Report. Amongst other subjects touched on in the report is the advisability of adopting a uniform scale and projection for the synoptic weather charts of all countries. It is gratifying to see the increased number of references to scientific researches, some of fundamental importance which are being promoted by the Meteorological Council. The fulfilment of the daily weather forecasts, however, shows no improvement, but that, we may hope, is due rather to a higher standard being applied to results than to less accurate prevision. The Council has decided to publish no sunshine observations made by recorders the results of which are not comparable with the standard Campbell-Stokes pattern.

Hourly Readings obtained from the Self-Recording Instruments at Four Observatories under the Meteorological Council, 1901. Thirty-third year. New Series. Vol. II. London. Printed for H.M. Stationery Office, 1904. Size 12 × 10. Pp. xiv. + 198. Price 25s.

ONE of the volumes in arrear. The preparation of the others is, we are glad to learn, well advanced.

THE GLACIAL SNOW OF BEN NEVIS.

By Rev. R. P. Dansey.

The assertion that Great Britain can boast a glacier will probably seem to most people a bold one. The sceptical will, the writer trusts, be more inclined to believe it after perusing these notes. Ben Nevis, as every one knows, is the highest summit in Britain—4,406 feet above sea level, 110 feet above its rival, Ben Macdhui, of the Cairngorms. But it is somewhat surprising to find that the area of Ben Nevis above 4,000 feet is not quite so large as the corresponding area of Ben Macdhui, or indeed of Braeriach. If, moreover, the 3,000 feet contour line is taken, the contrast is still more startling, for it will be found that at least fifteen of the flat-topped Cairngorms have a larger surface above 3,000 feet than Ben Nevis possesses. The proximity of Ben Nevis to the western seaboard ensures it a very heavy precipitation, of which perhaps quite half, if not more, falls as snow. The precipitation on Ben Nevis is much greater than on the Cairngorms, hence we may expect a greater depth of snow than on the former mountains, but the nearness of Ben Nevis to the sea, and therefore its greater mildness, probably tend to counterbalance its greater snowfall.

Corrie of Alt-a-Mhuilinn, Ben Nevis, showing Site of Glacier at the end of April.

But there is one especial feature which favours the accumulation and duration of snow on Ben Nevis; this feature is not to be found in nearly such a marked degree on any other Scottish mountain. The summit plateau, which rises steeply from the S.W.—the Glen Nevis side—terminates, after forming the summit crest, in a magnificent series of precipices, nearly two miles in length, overlooking the N.E. face. At the bottom of these precipices runs the small stream of the Allt-a-Mhuilinn, whence the corrie takes its name. On the other side of this, rise again the steep scree-covered slopes of Cairn Mor Dearg, 4,012 feet, which at the head of this great corrie joins Ben Nevis on the east by an arête which never falls below 3,478 feet. It will thus be seen that the Allt-a-Mhuilinn corrie is enclosed on all sides except the north by very high ground. Indeed, under the summit of Ben Nevis the precipices are 2,000 feet in height, and into these grim recesses the summer sun never entirely penetrates. These grand cliffs however, their two miles of length seamed by buttress, ridge and gulley, not only keep off the sun but they also intercept the warm Atlantic winds which blow over the top and on to the slopes of the opposite mountain, Cairn Mor Dearg, leaving the snow-covered corrie in a cold atmosphere of its own making.

It will now be seen how favourably situated is this great corrie under the N.E. precipices of Ben Nevis for the accumulation and duration of snow.

And now as regards that accumulation. By far the greater part of the snow that falls on Ben Nevis with all winds from S. by W. to W.N.W.—which are the prevailing winds and bring the heaviest snowfalls—is swept off over the precipices, where it accumulates in the great hollows and gullies underneath, in the Allt-a-Mhuilinn Corrie. The maximum depth on the summit is generally reached about the end of April or some time in May. The snow usually disappears from the summit about the beginning of July, except drifts, but the much greater accumulation below still remains. The minimum depth of snow under the precipices is usually found at the beginning of September, but as I have never visited the mountain in summer I am indebted to the Rev. A. E. Robertson for the following information. But, first, what constitutes a glacier? Where does the distinction between a glacier and nevé come in? The glaciers of Ben Nevis—there are two—are *not* glaciers, in so far as they are not fed permanently by high level snows as are real glaciers. But, says Mr. Robertson, "if you were to examine into it, I am sure you would find them practically ice, say after 12 or 24 inches below the surface, and I think also they would show glacial movement as well, so if that makes a glacier. then I think you have it on Ben Nevis." They have never been quite melted away within living memory, so no one knows what is below, or how much is below. Mr. Robertson crossed the largest "glacier" between the "Observatory Ridge" and the "N.E. Buttress," (climbers' names for routes up the precipices,) in August last, and said the length of the "glacier" from top to

bottom was then 300 feet; that it was of an average breadth of 50 yards, hard as a board, ribbed just like nevé in the Alps, and that it would not melt much more, if at all, that year. In many places at its side he could look over into the bergschrund between the rocks and the snow and could see down a great way, in many places 50 feet; so Mr. Robertson concludes that if it was 50 feet at the sides it must have been much more in the middle. The rocks near it were heavily glaciated and rounded off. Mr. Robertson, who has a knowledge of all the mountains over 3,000 feet high in Scotland, says that it is on Ben Nevis only that you will find your semi-glacier if at all, and that the snow-beds in the Cairngorms—the next nearest thing—are much more open and therefore more liable to be practically melted away in a hot summer. The level of the Ben Nevis "glacier" would be about 3,000 feet, part of it higher, and part, perhaps, lower. The snow drifts on the Cairngorms are much more open and exposed, and therefore more liable to great variations, if the weather be very hot or very cold in summer, and the nearest approach to the snow-beds (glaciers) on Ben Nevis that Mr. Robertson has seen was a large drift on Ben Macdhui above the Feithe Buidhe, which he once saw practically gone in September some years ago.

The corrie of the Allt-a-Mhuilinn is probably the wettest spot in Great Britain; if a rain gauge were placed, as Mr. Gethin Jones recently suggested in these pages, half-a-mile on the lee side of the summit of Ben Nevis, that is the side opposite to that on to which the prevailing rain-bearing winds blow, this corrie would be the spot. But the difficulties attending its reading would be very great, especially from October to June, when the corrie is often full of drift snow; and on the advent of warmer weather, avalanches, due chiefly to the giving way of the cornices on the cliffs above, crash right down into the centre of the corrie, so that unless daily observations could be taken, the records would be of little value, as the gauge would soon be snowed up and lost. Even with daily observations the records could only be approximate, unless the observer was always on the spot and could take the measurements hour by hour, as was done at the Summit Observatory, now unfortunately closed through lack of funds.

Having only visited the Corrie of the Allt-a-Mhuilinn at the end of April, three years in succession, when the snow is at its maximum depth, the writer has not had an opportunity for studying the "glaciers," as they were then indistinguishable in the vast wilderness of snow. This year he hopes to photograph them in July or August. It would be interesting if photographs could be taken of them twice monthly, from the beginning of July to the end of September, till all melting had practically ceased. A series of photographs thus obtained might be published and compared, care being taken to remember the date on which each was taken. A piece of iron, too, might be driven deeply into the ice at, say the beginning

of July, and a mark made in the rocks alongside and the rate of movement—if any—of the glacier might thus be obtained by observations at certain intervals. I may mention that the head of the Allt-a-Mhuilinn Corrie, where the "glaciers" are, is about three hours' walk from Fort William.

A QUARTER OF A CENTURY'S RAINFALL AT THROCKING, HERTS.

By Rev. C. Wigan Harvey.

With the year 1904 I completed 25 years of rainfall observations at Throcking, Herts (487 ft. above sea-level), of which I place before your readers the yearly totals, and the ratio which each year bears to the 25 years' average.

	Total Fall. in.	Percentage of Average. %	Max. Fall in 24 hrs. in.	Rainy Days.
1880	27·41	114	1·22	157
1881	27·32	113	1·36	186
1882	27·92	116	1·04	193
1883	25·95	107	1·20	169
1884	18·39	77	1·60	138
1885	26·22	109	1·25	169
1886	25·24	105	1·10	166
1887	18·26	76	0·79	150
1888	22·87	94	0·75	178
1889	25·57	106	2·60	165
1890	20·73	86	1·24	171
1891	26·64	110	1·02	212
1892	25·62	106	1·41	171
1893	22·34	92	1·12	168
1894	23·26	96	1·09	203
1895	24·50	101	1·33	165
1896	26·60	110	0·93	177
1897	23·41	97	1·15	177
1898	20·71	85	1·08	170
1899	24·23	100	0·96	182
1900	24·49	101	0·98	178
1901	19·73	82	0·96	134
1902	17·97	74	0·69	161
1903	36·36	150	2·00	201
1904	22·38	93	1·09	201
Aver.	24·16	100	2·60	174

It may be noted that the year of least rainfall in the period, 1902, when the fall was 26 per cent. below the average, and the year of greatest rainfall, 1903, when the fall was 50 per cent. above the average, are consecutive. The greatest monthly fall occurred in October, 1903, when 5·93 in. were registered; and the smallest monthly fall in February, 1891, when only 0·01 in. was gauged.

There were 30 occasions on which 1 in. and upwards fell in 24 hours; on two of these it reached 1½ in., and on two it reached 2 in. These 30 falls occurred—1 in April, 3 in May, 3 in June, 7 in July, 4 in August, 4 in September, 4 in October, 2 in November, and 2 in December. The heaviest fall of rain was 2·60 in. on July 12th, 1899, the result of a series of thunderstorms; and the heaviest fall of snow was on February 15th, 1900, when 0·98 in. was registered. There were 25 periods of absolute drought (14 days or more without rain), the longest being a period of 30 days from March 17th to April 15th, 1893. There was, however, a period of 34 days from February 1st to March 6th, 1891, during which only 0·01 in. was registered. Snow was registered to the amount of 17·11 in. on 194 days, representing about 3 per cent. of the 25 years' aggregate fall (604·12 in.).

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting was held on Wednesday evening, February 15th, at the Society's Rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, being in the chair.

Mr. Edward Mawley read his "Report on the Phenological Observations for 1904." He said that the weather of the phenological year ending with November, 1904, was chiefly remarkable for the persistent rains in January and February, the absence of keen frosts in May, the long continuance of hot and dry weather in July, and the small rainfall during the autumn. Throughout the year wild plants came into flower behind their usual dates, but at no period were the departures from the average exceptional. The accompanying table shows the mean dates for the thirteen selected plants in the different districts of England.

	S.W.		S.		MIDLAND.		E.		N.W.	
YEAR.	Day of year.	Diff. from aver.	Day of year.	Diff. from aver.	Day of year.	Diff. from aver.	Day of year.	Diff. from aver.	Day of year.	Diff. from aver.
1891...	144	+10	144	+ 9	150	+11	147	+10	150	+ 6
1892...	139	+ 5	138	+ 3	144	+ 5	143	+ 6	147	+ 3
1893...	118	—16	122	—13	125	—14	123	—14	128	—16
1894...	126	— 8	130	— 5	135	— 4	127	—10	137	— 7
1895...	139	+ 5	138	+ 3	141	+ 2	138	+ 1	144	0
1896 .	125	— 9	128	— 7	132	— 7	130	— 7	134	—10
1897...	130	— 4	132	— 3	136	— 3	132	— 5	142	— 2
1898...	133	— 1	135	0	138	— 1	136	— 1	141	— 3
1899...	136	+ 2	136	+ 1	141	+ 2	138	+ 1	145	+ 1
1900...	142	+ 8	141	+ 6	144	+ 5	143	+ 6	152	+ 8
1901...	138	+ 4	139	+ 4	141	+ 2	139	+ 2	144	0
1902...	139	+ 5	140	+ 5	145	+ 6	142	+ 5	152	+ 8
1903...	134	0	134	— 1	137	— 2	134	— 3	145	+ 1
1904...	139	+ 5	139	+ 4	142	+ 3	140	+ 3	149	+ 5
Mean ...	134	...	135	...	139	...	137	...	144	...

— signifies *early* and + *late*.

Such spring migrants as the swallow, cuckoo and nightingale made their appearance in this country at as nearly as possible their usual time. The yield of wheat per acre was the smallest since 1895, while those of barley, beans and peas were also deficient. On the other hand, there were good crops of oats, potatoes and mangels. The best farm crops of the year were, however, those of hay, swedes and turnips. Both corn and hay were harvested in excellent condition. Apples were everywhere abundant, and all the small fruits yielded well, especially strawberries, but there was only a moderate supply of pears and plums.

The President said that Dr. Gatty, who had made a study of the

question of the migration of birds, had found that they always followed practically the same course, and that they were not much influenced by the character of the season, whether it was favourable or otherwise.

Dr. W. N. Shaw said that he had been engaged recently in an attempt to summarise the meteorological data of the "Weekly Weather Report" in a form which would facilitate inquiry into the meteorological conditions of observed phenological results, the yield of crops, and other similar questions. One aspect of the inquiry, the relation between autumn rainfall and the yield of wheat, had already been noticed in *The Times* (see this Magazine for February). It had found an explanation of the deficient yield of 1904, after the favourable spring and summer of that year, in the excessive rainfall of the autumn of 1903.

Mr. H. Mellish said that in his own immediate neighbourhood in Nottinghamshire the swedes and turnips were the worst products of the year.

Mr. Baldwin Latham suggested that the deficiency in the yield of the wheat crop in 1904 was due to the excessive wet period in the year 1903, when a large amount of percolation took place, which washed out the soluble manurial elements and left the soil impoverished. It was well known that the effect of drought on the growth and yield of wheat was nothing like so detrimental as excessive wet, and the effect of the diminution of percolation during last summer and autumn could not but have a beneficial effect in producing a good wheat harvest in the present year.

Captain D. Wilson-Barker, Mr. J. E. Clark, and Mr. F. Gaster also took part in the discussion, and Mr. E. Mawley replied.

The other papers read were :—

"Observations of Meteorological Elements made during a Balloon Ascent at Berlin, September 1st, 1904," by Dr. H. Elias and Mr. J. H. Field; and

"The Winds of East London, Cape Colony," by Mr. J. R. Sutton.

The following gentlemen were elected Fellows of the Society :—Capt. G. Caie, Mr. G. A. Fernandez, Mr. E. Holt, Mr. A. E. Mitchell, and Mr. J. M. G. Shaw.

METEOROLOGICAL OBSERVATIONS IN PEMBA DURING 1903 AND 1904.

By Theodore Burtt.

The following statistics of climatological observations at the Friends' Industrial Mission, Pemba, East Africa, summarise and supplement those published in this Magazine for April, 1901, and October, 1902.

It will be noticed that there is but little variation in temperature between one year and another, and apparently no relation between

the temperature and the rainfall. The highest temperature in the sun was 175°.

It is very noticeable how the rainfall has decreased in the five years, but 1904 shows a heavier rainfall than either of the two preceding years. Though I have no record of 1898, I remember it as an unusually dry year, the rainy season being almost a failure; 1897, on the other hand, was a much wetter year. From the accompanying table of 1903 it will be seen that the lack of rain was chiefly during the rainy season in April and May. May is distinctly the wettest month in the year, though in 1902 and 1904 there was a little more rain in April. During May, 1899, 56·16 in. of rain fell, 13½ inches falling in 48 hours.

Meteorological Observations in Pemba.

Years.	Mean Max.	Mean Min.	Absolute Max.	Absolute Min.	Rainfall.	Rainy Days.
	°	°	°	°	in.	
1899	83·3	70·2	92·0	65·0	105·24	149
1900.....	83·5	71·3	95·0	66·0	90·35	160
1901.....	81·8	70·4	90·5	65·0	92·78	166
1902.....	82·8	71·4	91·0	67·0	68·72	132
1903.						
January.....	84·6	73·9	90·0	70·5	4·90	5
February	84·7	73·1	89·5	71·0	2·00	4
March.....	86·7	75·2	91·5	71·5	1·40	5
April	83·1	72·2	86·5	70·0	13·09	24
May	80·0	71·0	85·0	68·5	17·93	24
June	81·3	70·5	83·0	69·0	5·22	13
July	79·4	69·0	82·0	66·0	3·15	15
August	79·5	68·4	84·0	67·0	1·14	14
September.....	80·9	68·6	84·0	67·5	·52	6
October	82·8	70·0	86·0	68·0	1·91	2
November	80·9	71·7	86·0	70·0	2·65	11
December	83·2	73·3	87·0	70·0	9·33	15
Year, 1903.....	82·3	71·4	91·5	66·0	63·24	138
1904.						
January.....	83·5	72·9	90·5	71·5	2·12	10
February	84·5	72·3	86·0	71·0	·23	2
March.....	84·4	72·4	90·0	70·0	5·46	11
April	80·6	71·1	86·0	66·0	23·50	20
May	79·2	70·7	84·0	69·0	19·74	27
June	78·8	69·2	82·0	66·0	12·13	17
July	77·4	67·7	80·0	65·0	3·27	15
August	77·9	67·4	80·0	66·0	·97	8
September.....	79·6	68·2	82·0	66·0	1·11	8
October	81·2	69·2	86·0	68·0	1·71	8
November	81·7	70·9	87·0	68·0	13·34	17
December	82·5	72·9	85·0	72·0	2·65	13
Year, 1904.....	80·9	70·4	90·5	65·0	86·23	156

RAINFALL AND TEMPERATURE, FEBRUARY, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	Sun. Sunshine Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	·79	— ·83	·19	26	12	54·4	5	30·6	20	2	1
II.	Tenterden ...	·76	— 1·09	·43	26	14	56·0	5	28·5	12	6	1
,,	Hartley Wintney ...	·66	— 1·40	·18	25	13	59·0	19	29·0	12	4	1
III.	Hitchin ...	1·00	— ·54	·49	26	13	52·0	5, 16	28·0	19, 20	...	
,,	Winslow (Addington) ...	·56	— 1·17	·14	26	12	55·0	5	27·0	20	9	2
IV.	Bury St. Edmunds (Westley)	1·37	— ·18	·38	26	13	53·0	5	26·0	20	10	...
,,	Brundall ...	1·43	— ·06	·17	20	19	53·8	5	26·8	8	6	1
V.	Alderbury ...	·72	— 1·49	·26	25	12	56·0	18	...	...	...	...
,,	Winterbourne Steepleton ...	·79	— 2·32	·32	25	14	55·1	14	27·2	12	8	1
,,	Torquay (Cary Green) ...	·84	— 2·03	·46	25	10	56·8	14	32·0	25	1	9
,,	Polapit Tamar [Launceston]	1·63	— 1·21	·37	25	17	53·9	14	26·8	25	9	1
,,	Bath ...	·86	— 1·26	·27	25	10	54·8	14	21·5	25	5	1
VI.	Stroud (Upfield) ...	·80	— 1·33	·26	25	14	53·0	16	27·0	24	8	...
,,	Church Stretton (Woolstaston)	1·35	— ·92	·33	26	18	52·5	5	26·0	22	11	...
,,	Bromsgrove (Stoke Reformatory)	·50	— 1·13	·14	6	9	52·0	18	24·0	11	16	...
VII.	Boston ...	·54	— 1·01	·17	17	7	53·0	16	25·0	8	12	...
,,	Worksop (Hodsock Priory).	·73	— ·85	·23	25	9	58·2	18	24·5	8	9	2
,,	Derby (Midland Railway) ...	·67	— ·99	·16	26	15	56·0	18	28·0	7	8	...
VIII.	Bolton (The Park) ...	2·86	+ ·19	·49	13	20	53·9	18, 19	29·0	12	6	1
IX.	Wetherby (Ribston Hall) ...	1·40	— ·23	·35	28	12	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	4·53	— ·21	·81	28	19	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	1·16	— ·70	·42	28	11	55·0	18	28·0	8, 12	6	2
X.	Newcastle (Town Moor) ...	·91	— ·67	·15	25	15	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	9·86	— 1·78	1·41	25	21	49·1	4	21·5	22	8	...
XI.	Cardiff (Ely) ...	1·17	— 1·96	·33	26	17	...	...	...	...	...	...
,,	Haverfordwest (High St.) ...	1·83	— 1·87	·53	25	22	52·8	18	29·2	25	3	1
,,	Aberystwith (Gogerddan) ...	2·74	— ·29	·37	1	21	54·0	7, 14	21·0	21	8	...
,,	Llandudno ...	1·87	— ·10	·40	6	17	53·0	16	31·0	25	3	...
XII.	Cargen [Dumfries] ...	2·71	— ·91	·78	25	14	52·0	13, 18	25·0	12	10	...
,,	Lilliesleaf (Riddell) ...	1·17	— 1·24	·21	18	18	50·0	13a	22·0	11, 12	16	1
XIII.	Edinburgh (Royal Observy.)	1·34	...	·36	18	13	53·3	18	24·6	12	7	1
XIV.	Colmonell ...	3·95	+ ·28	·80	25	19	51·0	5, 8b	20·0	23	8	...
XV.	Tighnabruaich ...	5·74	+ 1·17	·65	26	23	46·0	14	24·0	11	17	1
,,	Mull (Quinish) ...	5·03	+ ·53	·97	25	24	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	·80	— 1·30	·20	1	11	52·4	14	24·9	12	13	...
XVII.	Braemar ...	2·36	— ·34	·38	2	15	50·7	5	12·3	22	...	1
,,	Aberdeen (Cranford) ...	2·04	— ·29	·40	27	18	56·0	5, 9	24·0	11	15	...
,,	Cawdor (Budgate) ...	2·45	+ ·59	·37	1	18	...	...	...	...	...	...
XVIII.	Invergarry ...	7·23	+ 2·34	1·25	18	19	...	...	...	...	...	...
,,	Bendamph ...	11·66	+ 4·89	1·74	12	25	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	3·73	+ 1·34	·50	3	19	54·0	18	24·5	12	12	...
,,	Castletown ...	4·54	...	·63	9	24	51·0	5	23·0	11, 12	12	...
XX.	Killarney ...	2·80	— 2·64	1·25	26	20	55·5	5	23·0	23	...	...
,,	Waterford (Brook Lodge) ...	1·14	— 2·16	·58	25	14	56·0	18	26·0	23, 24	7	...
,,	Broadford (Hurdlestown) ...	1·84	— ·35	·68	25	21	50·0	6, 8, 9	25·0	22	7	...
XXI.	Carlow (Browne's Hill) ...	1·04	— 1·57	·39	25	11	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	·75	— 1·23	·22	25	12	55·8	18	32·0	20	1	1
XXII.	Ballinasloe ...	1·63	— ·85	·32	25	22	60·0	8, 13	19·0	24	11	...
,,	Clifden (Kylemore House) ...	5·08	— 1·00	·77	25	19	...	...	...	...	...	...
XXIII.	Seaforde ...	1·70	— 1·27	·54	25	17	51·0	16	26·0	22	11	1
,,	Londonderry (Creggan Res.)	3·78	+ 1·05	·62	27	22	...	...	...	...	...	...
,,	Omagh (Edenfel) ...	1·98	— ·51	·30	25	21	51·0	5, 8	26·0	22	8	1

+ Shows that the fall was above the average; — that it was below it. a—and 14, 15 b—and 9, 16.

SUPPLEMENTARY RAINFALL, FEBRUARY, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	·85	XI.	New Radnor, Ednol	1·91
,,	Ramsgate, West Cliff.....	·89	,,	Rhayader, Nantgwillt	4·08
,,	Hailsham	·74	,,	Lake Vyrnwy	3·39
,,	Crowborough	1·18	,,	Ruthin, Plâs Drâw.....	1·14
,,	Osborne.....	·62	,,	Criccieth, Talarvor.....	1·37
,,	Emsworth, Redlands.....	·71	,,	Anglesey, Lligwy	1·32
,,	Alton, Ashdell	1·20	,,	Douglas, Woodville	1·94
,,	Newbury, Welford Park ...	1·01	XII.	Stoneykirk, Ardwell House	2·05
III.	Harrow Weald	·91	,,	Dalry, Old Garroch	5·61
,,	Oxford, Magdalen College..	·43	,,	Langholm, Drove Road.....	3·08
,,	Banbury, Bloxham...	·72	,,	Moniaive, Maxwelton House	3·41
,,	Pitsford, Sedgebrook.....	·58	XIII.	N. Esk Reservoir [Penicuick]	2·65
,,	Huntingdon, Brampton.....	·78	XIV.	Maybole, Knockdon Farm..	3·28
,,	Wisbech, Bank House	1·09	,,	Glasgow, Queen's Park	2·43
IV.	Southend	·56	,,	Campbeltown, Redknowe...	3·62
,,	Colchester, Lexden.....	·67	XV.	Inveraray, Newtown.....	6·88
,,	Saffron Waldon, Newport...	1·36	,,	Ballachulish House.....	9·15
,,	Rendlesham Hall	·98	,,	Islay, Eallabus	4·07
,,	Swaffham	1·04	XVI.	Dollar	2·18
,,	Blakeney	1·16	,,	Loch Leven Sluices	1·22
V.	Bishops Cannings	·73	,,	Balquhidder, Stronvar	4·77
,,	Ashburton, Druid House ...	1·62	,,	Coupar Angus Station	·74
,,	Okehampton, Oaklands.....	2·38	,,	Blair Atholl.....	2·29
,,	Hartland Abbey	1·49	,,	Montrose, Sunnyside.....	·99
,,	Lynmouth, Rock House ...	1·54	XVII.	Alford, Lynturk Manse ...	1·65
,,	Probus, Lamellyn	1·38	,,	Keith..... ..	2·42
,,	Wellington, The Avenue ...	1·04	XVIII.	N. Uist, Lochmaddy.....	5·21
,,	North Cadbury Rectory ..	·94	,,	Aviemore, Alvey Manse ...	2·69
VI.	Clifton, Pembroke Road ...	·86	,,	Loch Ness, Drumnadrochit.	3·94
,,	Moreton-in-Marsh, Longboro'	·97	,,	Glencarron Lodge	...
,,	Ross, The Graig	·77	,,	Fearn, Lower Pitkerrie.....	2·26
,,	Shifnal, Hatton Grange.....	·69	XIX.	Invershin	4·53
,,	Wem Rectory	·81	,,	Altnaharra	6·22
,,	Cheadle, The Heath House.	1·00	,,	Bettyhill	3·89
,,	Coventry, Kingswood	·96	,,	Watten	3·27
VII.	Market Overton	·74	XX.	Cork, Wellesley Terrace ...	1·42
,,	Market Rasen	·75	,,	Darrynane Abbey	3·07
,,	Bawtry, Hesley Hall.....	·63	,,	Glenam [Clonmel]	2·01
VIII.	Neston, Hinderton.....	1·11	,,	Ballingarry, Gurteen	1·75
,,	Southport, Hesketh Park...	1·24	,,	Miltown Malbay.....	1·71
,,	Chatburn, Middlewood	2·53	XXI.	Gorey, Courtown House ...	1·01
,,	Cartmell, Flookburgh	2·25	,,	Moynalty, Westland	1·76
IX.	Langsett Moor, Up. Midhope	3·06	,,	Athlone, Twyford	1·53
,,	Scalby, Silverdale	1·46	,,	Mullingar, Belvedere.....	1·71
,,	Ingleby Greenhow	1·43	XXII.	Woodlawn	2·16
,,	Middleton, Mickleton	1·62	,,	Westport, Murrisk Abbey..	2·64
X.	Beltingham	1·22	,,	Crossmolina, Enniscoe	3·63
,,	Font Reservoir, Fallowlees.	1·25	,,	Collooney, Markree Obsy...	3·96
,,	Ilderton, Lilburn Cottage...	·98	XXIII.	Enniskillen, Portora	2·97
,,	Keswick, The Bank	3·83	,,	Warrenpoint	1·33
XI.	Llanfrechfa Grange.....	·82	,,	Banbridge, Milltown	1·34
,,	Treherbert, Tyn-y-waun ...	4·20	,,	Belfast, Springfield	2·61
,,	Carmarthen, Friary	1·93	,,	Bushmills, Dundarave	2·92
,,	Castle Malgwyn	2·19	,,	Stewartstown	2·02
,,	Plynlimon.....	7·45	,,	Killybegs	3·77
,,	Tallyllyn	1·40	,,	Horn Head	3·59

METEOROLOGICAL NOTES ON FEBRUARY, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A mild and dry month, rather showery in the latter half. Violent squalls with H on 26th. Notable absence of frost. Duration of sunshine 68·1* hours, and of R 22·4 hours. Mean temp. 42°·2, or 2°·4 above the average.

TENTERDEN.—A pleasant month on the whole, but variable. Out of 14 rainy days 11 had only ·01 or ·02 in. S on 11th and 20th. Duration of sunshine 89·5† hours.

CROWBOROUGH.—Mild with scanty R, nearly half of which fell on 26th. Several H storms during the last 10 days. Mean temp 40°·3.

OSBORNE.—R about 70 per cent. below the average of 46 years.

HARTLEY WINTNEY.—Another dry month, with remarkably mild and fine weather. Great scarcity of water in ponds and springs. The last week was stormy with light R. Ozone on 25 days, with a mean of 4·0.

PITSFORD.—Very dry. The first part was pleasant, the latter cold and wet. R 1·41 in. below the average of 1880-89. Mean temp. 40°·6.

BURY ST. EDMUNDS.—Another dry month. Rivers and ponds very low and water supply getting short. Westerly winds on 23 days.

WINTERBOURNE STEEPLETON.—A very dry month, with mean temp. about 3° above the average, and many very beautiful days.

TORQUAY.—Mean temp. 45°·0, or 1°·9 above the average. Duration of sunshine 98·3* hours, or 17·9 hours above the average. Mean amount of ozone 5·2. Max. 9·0 on 27th, with W. wind; min. 1·0 on 25th with N. wind.

WELLINGTON.—Another remarkably dry month, the R being more than 1·50 in. below the average. The temp. was generally high until 19th, when there followed a few cold days with some S.

NORTH CADBURY.—The cloud, wind and temp. were exactly normal, but the range of temp. was small, and frosts were few and slight. Extremely dry till 26th, when there was a rapid change to cyclonic conditions.

CLIFTON.—Very dry, though with frequent and light drizzle, till 25th, when a sudden change took place with the arrival of a deep cyclone in the N., and stormy weather. R one-third of the average. The R of January and February together was only 1·54 in., the least in 49 years except in 1896, when only 1·18 in. fell.

ROSS.—The dry period, which, with the exception of 10 days, Dec. 4th-13th, had continued from September 14th, or for 164 days, lasted till midnight on February 25th. In this time only 5·88 in. of R fell, or 8·92 in. less than the average.

WEM.—On the whole dry and fine, but with much cold wind during the last 10 days.

WORKSOP.—Mild and windy. The sixth dry month in succession, the fall of the six months, September to February, being less than in any of the last 29 years.

BOLTON.—The R was in excess for the first time since May, 1904. Mean temp. 40°·0, or 2°·5 above the average. Duration of sunshine 48·2* hours, or 6·3 hours above the average. Mean amount of ozone 2·3, being 1·6 above the average.

SOUTHPORT.—An anomalous month. Very stormy and somewhat mild, westerly winds again greatly predominating, but unusually dry and sunny, with high pressure. Duration of sunshine 20* hours above the average. R ·80 in. below the average, and underground water remarkably low. Ozone very *abundant*.

UPPER MIDHOPE.—From 1st to 24th dry and windy, with occasional slight R, sleet, H and S. From 25th it was very wintry, with heavy R, sleet, S and H.

CARMARTHEN.—Mild and dry in the early part. Cold N. and N.E. winds later, with showers of cold R, H, sleet and S.

HAVERFORDWEST.—Fine and mild generally, with small R. Sharp frost from 21st to 28th, causing a wholesome check to vegetation. Duration of sunshine 70·2* hours. Gales on 5 days.

DOUGLAS.—R in small quantities on 21 days, but sunshine and temp. above the average except in the last week, when it was cold. Owing to the prevalence of strong gales vegetation was backward in spite of the mild weather and sunshine.

SCOTLAND.

CARGEN [DUMFRIES].—A "dropping" month without exceptionally heavy R. The temp. was high and vegetation forward.

LANGHOLM.—R 1·27 in, below the average of 29 years. The last week was very cold, with frequent sleet and H.

INVERARAY.—Stormy and unsettled throughout, but mild.

COUPAR ANGUS.—An ideal, open month, with vegetation advanced. Morning frosts were numerous, but in no case severe. Mean temp. 39°·4. R fell in small quantities on many days.

LYNTURK.—R still considerably below the average. Till 19th there were high winds, several times reaching the force of a gale, but thereafter it was fairly quiet.

DRUMNADROCHIT.—R 1·06 in. above the average of 19 years.

ALTNAHARRA.—Very severe gales were experienced in the first half. Exceptionally keen frost at times.

WATTEN.—Boisterous and very changeable, with storms of wind, and short S and R storms. Generally fresh and open and at times fine.

CASTLETOWN.—Till 20th damp, cold and cloudy. From 20th to 23rd clear, cold and dry, with remarkably high bar. The last few days were very damp.

IRELAND.

DARRYNANE.—The first three weeks were mild and fine, the rest cold with H showers, some S and strong N.W. winds. R 74·5 per cent. of the average of 25 years.

HURDLESTOWN.—The first three weeks were mild, the last cold and severe.

MILTOWN MALBAY.—Very little R. Mild to the 19th, thence to the end inclement and stormy, with S, H, T and L.

DUBLIN.—Mild and open till the 18th, when a change to cold weather took place. The last 10 days were wintry, with R, H and sleet on 25th and following days. Mean temp. 43°.6, or 1°·1 above the average.

MARKREE OBSERVATORY.—Fair generally until the last few days, when a severe storm set in with H, sleet and S.

BANBRIDGE. R ·76 in. below the average of 40 years.

BELFAST.—A most useful month for the land till 26th, when the heavy sleet and S undid the previous good. R just under the average.

OMAGH.—A very favourable winter month, with temp. above, and R below, the average. The duration of bright sunshine was above the average, but it was accompanied by much barometric oscillation.

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* Campbell-Stokes. † Jordan'

Climatological Table for the British Empire, September, 1904.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	74·9	5	39·1	26	65·7	48·2	51·3	87	121·2	31·1	1·17	11	4·0
Malta	88·5	1	62·3	30	81·8	68·1	65·0	72	138·9	57·9	2·30	6	3·9
Cape Town	84·7	17	40·6	4	65·0	49·6	50·3	75	...	...	2·48	11	5·3
Durban, Natal	101·1	3	50·6	11	76·5	58·6	...	...	142·9	...	·58	10	5·1
Johannesburg	79·5	30	26·5	10	67·8	45·0	37·5	55	...	24·8	·13	2	2·2
Mauritius	78·8	17	50·9	21	76·4	60·0	57·0	69	148·2	42·0	1·04	15	6·1
Calcutta	93·4	18	74·9	10	89·3	77·6	76·3	82	163·2	72·0	5·72	12	6·3
Bombay	88·1	27	75·4	25	85·6	77·8	74·7	80	136·7	69·4	1·81	11	5·9
Madras	100·5	18	72·6	2	95·7	77·2	70·7	67	161·2	70·7	3·51	10	5·2
Kodaikanal	67·0	26	48·5	25	62·8	51·3	54·0	83	136·6	38·2	6·51	16	6·3
Colombo, Ceylon	87·6	13	74·8	18	85·7	77·2	72·7	79	153·0	72·6	1·77	16	5·6
Hongkong	88·9	1	73·0	19	85·0	76·3	73·8	81	145·8	...	9·77	22	6·6
Melbourne	69·2	24	35·1	12	62·6	45·4	40·2	70	133·7	27·6	1·26	12	6·0
Adelaide	79·6	17	37·9	29	64·6	46·0	43·6	65	140·1	32·5	·69	10	4·2
Coolgardie	83·2	16	35·2	2	68·8	46·5	44·5	62	153·4	26·0	2·05	15	5·0
Sydney	80·9	25	42·0	30	66·1	49·0	44·3	65	119·1	32·8	1·00	16	4·3
Wellington	64·0	16*a*	35·7	24	56·5	42·4	47·3	75	115·0	33·0	5·22	20	7·0
Auckland	63·0	6,30	41·0	23	59·1	48·4	47·2	78	130·0	37·0	3·91	24	5·8
Jamaica, Negril Point	89·9	4	70·1	2	86·7	72·7	74·2	80	...	...	6·31	13	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	..	...
Grenada	88·8	5	70·4	22	84·7	74·4	72·0	76	152·0	...	9·14	23	3·7
Toronto	79·2	11	33·8	21	67·2	50·2	52·5	79	107·0	27·4	3·99	12	5·4
Fredericton	77·7	12	25·4	23	63·7	40·3	42·4	64	...	...	7·73	12	5·2
Winnipeg	78·0	27	26·0	20	62·1	40·8	...	...	...	...	1·88	11	6·5
Victoria, B.C.	73·4	13	43·0	19	65·6	49·3	...	...	...	...	·32	5	2·6
Dawson	60·6	11	7·8	19	46·5	27·6	...	...	...	...	1·01	6	4·4

a—and 28.

MALTA.—Mean temp. of air 74°·2, or 1°·9 below, and mean hourly velocity of wind 8·3 miles, or 0·5 above, averages. Mean temp. of sea 78°·0. T88 on 4 and L on 7 days.

Mauritius.—Mean temp. of air 1°·9, dew point 3°·2, and rainfall ·33 in., below averages. Mean hourly velocity of wind 10·1 miles, or 1·9 miles below average, mean computed direction E.S.E.

MADRAS.—Bright sunshine 180·2 hours. T88 on 4 days.

KODAIKANAL.—Bright sunshine 148 hours.

COLOMBO.—Mean temp. of air 81°·1, or 0°·3 above, of dew point 0°·6 below, and R 3·36 in. below, averages. Mean hourly velocity of wind 11·4 miles.

HONGKONG.—Mean temp. of air 80°·2. Bright sunshine 161·3 hours. Mean hourly velocity of wind 11·5 miles; mean direction E.

Adelaide.—Mean temp. of air 1°·9 below, and R 1·04 in. below, averages. Driest September with one exception (1896) in 66 years records.

Sydney.—Mean temp. of air 1°·3, R 1·97 in., and humidity 5·1, all below averages.

Wellington.—Mean temp. of air 0°·4 below, and R 1·00 in. above, averages.

Erratum.—Vol. **39**, p. 244, Johannesburg, last col., Cloud, *should be* 0·6, *not* 6·0 as printed.

Symons's Meteorological Magazine.

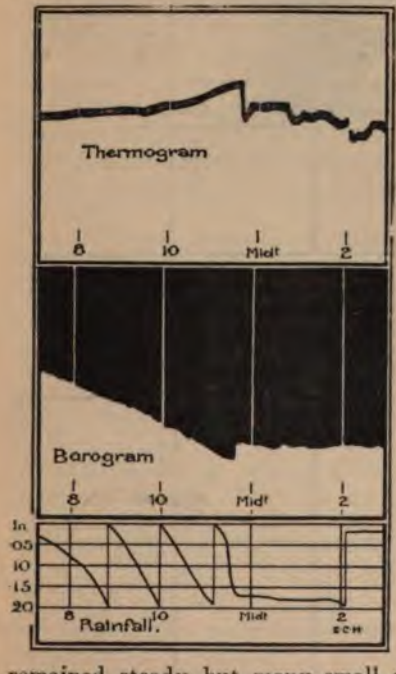
No. 471. APRIL, 1905. Vol. XL.

ON A FORM OF SUDDEN WEATHER CHANGE.

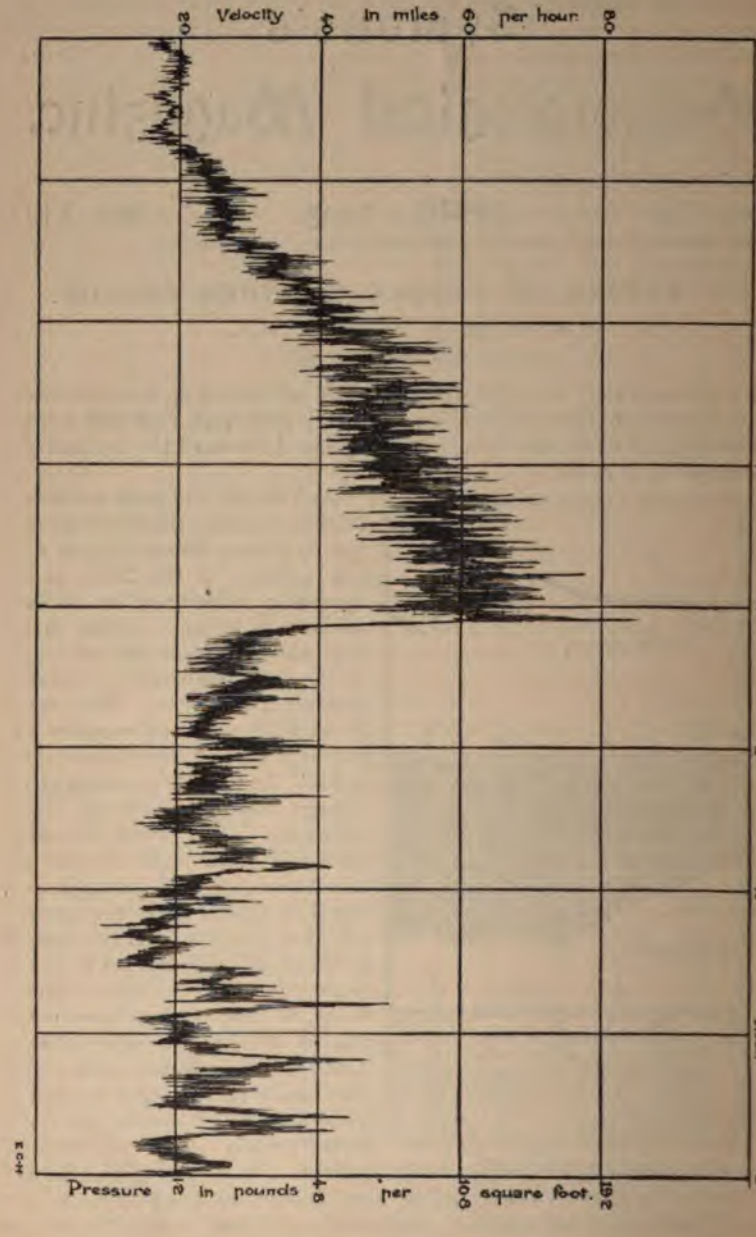
By R. G. K. Lempfert, M.A.

(*of the Meteorological Office.*)

The changes shown on the traces of the self-recording instruments at our western Observatories on February 25th and 26th last were so striking that, at the Secretary's request, I forward the following description of them.



At Valencia, our most western station, a strong southerly wind got up during the early part of the evening of the 25th, and reached a velocity of 40 miles an hour at 11 p.m. During this time the barometer fell briskly, while the temperature curve showed a slow rise. Rain set in at 6.30 p.m. and continued steadily during the following hours. At 11.35 p.m. an abrupt change took place in all the elements. The wind veered suddenly from south to west; the barometer rose through as much as 0·08 inch in the space of a few minutes, and the temperature fell 4·5 degrees in the same interval of time. The trace of the rain-gauge was almost vertical through a distance of 0·1 inch, and then the rain ceased; the total rainfall since 6.30 p.m. was about ·75 in. Subsequently the barometer remained steady, but many small oscillations were recorded. The temperature curve, which before the change occurred had been remarkably free from minor fluctuations, became very irregular.


Velocity in miles per hour
20
40
60
80
Pressure in pounds per square foot.
4
8
16
32
Midnight
2
4
6
8
10
Noon
2
Each

The wind direction was also much less steady, many temporary changes—of which the more prominent ones were accompanied by smart showers—being shown.

Turning now to Falmouth, we find the changes similar in many respects and yet different in others. The pressure tube anemogram is reproduced in the accompanying diagram. During the period of rapidly increasing velocity, the wind direction was from S.S.W., but the sudden drop from 84 to about 30 miles per hour shortly after 6 a.m. was accompanied by a shift of wind to W.S.W. The remaining part of the trace shows a series of oscillations of a period of about an hour, each of which was accompanied by a sudden veering of the wind through several points. The barogram is similar to that from Valencia in that it shows a brisk fall up to the time of change of wind and remains approximately steady afterwards, but the sudden increase of pressure, which was so very characteristic at Valencia, is only faintly indicated at Falmouth. In the thermogram a fall of temperature is indicated, but this change was also less sudden than at Valencia. The marked increase in the rate of rainfall at the time of the change of wind, and the subsequent clearing of the weather, were again very characteristic; the total rainfall between 2 a.m., the hour at which rain commenced, and 6.30 a.m. was 0·37 inch, about half the amount measured at Valencia.

The anemograms from Scilly and Holyhead show changes similar to those recorded at Falmouth, but the difference between the wind velocities in the southerly and westerly winds was not so marked. The change occurred at Scilly at 5 a.m., and at Holyhead at about 5.30 a.m.

At Kew the phenomena were less pronounced. A strong southerly wind prevailed during the morning of the 26th, but no definite hour can be assigned for its interruption. The barometer ceased falling at about 2 p.m.

The phenomena, described above, seem to suggest that we have here a case of an air current from the west cutting into a current from the south, and, in view of the heavy rainfall which accompanied the change, we may perhaps go a step further and regard the westerly current as forcing its way underneath the southerly one. The information at present available is too scanty to enable us to trace the passage of the phenomenon across the country; it would, however, be a matter of interest to see whether it was propagated along a linear front in a similar manner to hail and thunder squalls. I should be glad to hear from any of your readers whose self-recording instruments showed changes which may be brought into connexion with the effects I have described.

The isobaric distribution at 8 a.m. on February 26th was of the type generally described as a depression off the north-west of Scotland; the gradient was moderately steep, and the isobars were concave to a point situated, say, 200 miles to the north-west of

Stornoway. A line drawn slightly to the westward of Liverpool and Jersey separates the map into two portions. On its eastern side the wind was strong in force and generally southerly in direction (it was, however, S.W. at Portland Bill); on its western side it was westerly in direction and rather less strong in force. The same line separates a region of continuous rainfall from a region of detached clouds and occasional showers.

One further point is perhaps of interest. Two years ago, also in the month of February, a very similar series of changes was recorded under similar isobaric conditions at all stations in the south-west of England, and it would be interesting to know whether this type of weather is particularly frequent at this time of the year.

RECEPTION BY THE METEOROLOGICAL COUNCIL.

It is believed that the Report of the Treasury Committee is about to be acted upon, and the constitution of the Meteorological Office altered, although up to the date of going to press no definite announcement has been made, and nothing can yet be stated as to the future relationship between the national weather service and the Government.

On March 31st, the last day of its official year, the Meteorological Council was "At Home," in 63, Victoria Street, to a large party of men of science, and ladies. General Sir Richard Strachey, Chairman of the Meteorological Council, and Lady Strachey, received the guests, and most of the members of the Council were present, including Professor George Darwin, Admiral Sir William Wharton, and Dr. W. N. Shaw. The fourteen principal rooms of the Office were open for inspection, and an interesting collection of charts, diagrams, and instruments, was on view; which the members of the staff of the office were ready to exhibit and explain. A list of the exhibits formed an attractive memento of the occasion, the cover giving, in colour, reduced facsimiles of the Atlantic pilot-chart for April, and the daily weather chart for March 31st.

The exhibits were largely historical, serving to illustrate the development in the work of the Office from the time of Admiral Fitzroy to the present day. A number of notable records from recording instruments were shown, including those which revealed the air-waves round the world, started by the eruption of Krakatoa, and the twenty-four hour traces of continuous sunshine obtained on the Antarctic expedition of the *Discovery*. The instruments on view included Lord Kelvin's harmonic curve analyser, Sir Richard Strachey's harmonic curve compounder, Mr. F. Galton's pantagraph for reducing diagrams in different ratios for length and breadth, computing machines, and several of the new forms of apparatus which had been shown at the recent exhibition of the Royal Meteorological Society. Mr. Lempfert showed an ingenious application

of the "wheel of life," which represented in a vivid way the movement of a particle of air through an atmospheric depression.

In the forecast room a special weather chart was prepared at 4 p.m., and before the party broke up the later-comers had an opportunity of seeing the usual 6 p.m. chart prepared from the data as they were received. A good deal of interest was aroused by the series of special weather charts prepared in order to advise the captain of the Royal Yacht *Victoria and Albert*, as to the prospects of weather in the Channel, after the Queen had gone on board on March 14th, until the conditions were sufficiently favourable to make it prudent to go to sea on the 18th.

Dr. Shaw and all the members of the Office staff deserve to be congratulated on the happy result of their efforts in showing the work of the Meteorological Council at its best, and in making that work interesting and attractive to all.

EXHIBITION OF METEOROLOGICAL INSTRUMENTS.

A LARGE and interesting Exhibition of Meteorological Instruments, arranged by the Royal Meteorological Society, was held in the Library of the Institution of Civil Engineers, Great George Street, Westminster, from Tuesday, March 14th, to Friday, the 17th.

Since the Society's last Exhibition, in 1897, considerable improvements have been made in recording instruments, and there has also been a great development in the methods adopted for ascertaining the meteorological conditions of the upper air. The instruments used for these purposes consequently formed the characteristic portion of the Exhibition, which was admirably arranged in the spacious and convenient room. In the centre there was a railed-off enclosure arranged to represent a typical Climatological Station of the Royal Meteorological Society, with instruments in position.

The Meteorological Council showed in position the photographic barograph and the Beckley self-recording rain gauge which were in use at the Fort William Observatory from 1890 to 1904. Messrs. Negretti and Zambra exhibited their self-recording rain gauges, anemometers, and sunshine recorders, and also a number of other instruments. Messrs. J. Levi and Co. contributed a collection of most of Richard's (Paris) noted self-recording instruments. Mr. F. L. Halliwell showed his rain gauges, anemometers, and an evaporation tank fitted with his float and index for reading the water-level to ·01 in.

Mr. W. H. Dines exhibited the kites and meteorographs used by him at Crinan, as well as a Russian kite sent from St. Petersburg. Mr. P. Y. Alexander sent two rubber balloons which had been used as "*ballons sondes*." Meteorographs for use with kites and balloons were exhibited by M. L. Teisserenc de Bort, Mr. W. S. Bruce, Messrs. J. and A. Bosch, and Mr. J. J. Hicks. The kite camera and cage used in the Scottish Antarctic Expedition were also shown by Mr. Bruce. The Royal Meteorological Society exhibited the instru-

ments used by Mr. J. Glaisher in his famous balloon ascents for the British Association during 1862—66, which were placed in position on the board as used in the car of the balloon.

The Meteorological Council showed a number of instruments which had been used in the National Antarctic Expedition and also in several Arctic Expeditions. Mr. W. S. Bruce sent some of the thermometers used in the Scottish Antarctic Expedition. The Cambridge Scientific Instrument Company exhibited their electrical resistance thermometers and Callendar recorder. Dr. H. R. Mill showed a number of old pattern rain gauges used in the early experiments of Mr. G. J. Symons, and also a Redier barograph. Dr. W. N. Shaw and Mr. S. Skinner both exhibited their micro-barographs for the study of minor variations of atmospheric pressure. Mr. R. W. Munro showed the Dines pressure-tube anemometer, and Messrs. Lander and Smith contributed a set of their recording meteorological instruments. Mr. J. Baxendell exhibited his anemograph and snow-melting rain gauge; and anemometers were also shown by the National Physical Laboratory, Mr. C. Dales, Mr. J. J. Hicks, and Mr. R. M. Lowne.

The Astronomer Royal sent several patterns of sunshine recorders which were formerly used at the Royal Observatory, Greenwich. The Meteorological Council exhibited two sunshine recorders used by the National Antarctic Expedition while in the *Discovery's* winter quarters in 77° 50′ S. lat., the instruments being so constructed as to give continuous records for 24 hours.

Dr. W. N. Shaw gave demonstrations with his "thermopsychrophorus," which is an apparatus illustrating the cooling effect by the communication of heat under certain conditions to a mass of air in the free atmosphere. Mr. G. Simpson exhibited apparatus for measuring the amount of radio-active emanation in the atmosphere, and Herr R. Fuess, of Berlin, showed Assmann's aspiration psychrometer and other instruments.

Dr. J. L. Thomas exhibited a life-size "dummy," dressed in the remains of the clothes of a man who was struck by lightning near Cardiff on July 17th, 1903. Objects struck by lightning were also shown by the Royal Meteorological Society and by Messrs. J. W. Gray and Son.

The Exhibition also included a large collection of interesting meteorological photographs, records, drawings and maps.

A brief address was given each afternoon by Mr. W. Marriott, descriptive of the instruments included in the Exhibition: and the Exhibition succeeded in its purpose of attracting a large number of visitors interested in the science of the atmosphere.

At the meeting of the Royal Meteorological Society, on Wednesday evening, March 15th, the President, Mr. Richard Bentley, delivered an address on the Growth of Instrumental Meteorology.

After briefly touching on the historic and non-instrumental era of

Meteorology, he spoke of the seven great weapons of the meteorologist—the thermometer, and of later years the heliograph, for temperature—the hygrometer and rain gauge, for moisture—the barometer, for pressure—and the anemometer and kite, for the study of the upper air; and of the foundation of instrumental meteorology laid by Galileo, Torricelli, Wren and Hooke.

The President, in dwelling upon our indebtedness to Italy in science (as well as in art) from Galileo to Marconi, pointed out that the theory of rainfall was correctly enunciated as early as the beginning of the fourteenth century by Dante. He also dwelt on the great services rendered to the community by meteorologists, largely working voluntarily and at their own expense, and referred to the close observation kept by rain gauges on the water supply of the country—by anemometers protecting the traffic over some of our lofty and more exposed railway viaducts—by the use of the barometer for storm warnings and for the safety of miners—by the heliograph with relation to the ripening of fruits and crops—and regretted how much of the immense mass of information daily accumulating had still to be analysed and put to use. It was disappointing to find in so wealthy a country as this, and where the results could not fail to be of the greatest practical utility to the nation, that the means of digestion of this vast amount of data are so meagre and the aid given by the Government is so slender as to be a constant source of reproach, when compared with the large provision made for the same purpose in other countries.

Mr. W. Marriott also exhibited a number of lantern slides illustrating meteorological phenomena.

The following gentlemen were elected Fellows of the Society:—Dr. F. A. Barton, Mr. N. Gyles, Mr. F. W. Harmer, F.G.S., Major A. D. D. Kelly, Mr. J. M. Kerr, Assoc. M.Inst.C.E., and Captain E. R. McKinstry.

METEOROLOGICAL NEWS AND NOTES.

Professor C. H. Wind having been appointed to a Professorship in the University of Utrecht, has resigned the Directorship of the Dutch Meteorological Institute, and Dr. E. van Everdingen has been appointed provisional Director.

The British Association for the Advancement of Science meets this year in South Africa, but so far as we are aware no special sub-section for Cosmical Physics will meet. Papers on meteorology will probably be taken in Section A, and Dr. H. R. Mill hopes to be able to arrange for the usual Meteorological Breakfast at Cape Town on the morning when these papers are read. The keen interest taken in the study of the weather in South Africa will, it is hoped, lead to some interesting discussions.

THREE MONTHS' RAINFALL OF 1905.

Aggregate Rainfall for January—March, 1905.

Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	5·13	100	Bolton	8·90	100	Braemar	8·86	110
Tenterden	5·53	91	Wetherby.....	4·66	87	Aberdeen	6·33	88
Hartley Wintney	5·30	85	Arncliffe	13·58	84	Cawdor	8·82	143
Hitchin	4·94	101	Hull	3·83	70	Invergarry ...	21·66	133
Winslow	4·37	81	Newcastle.....	2·70	48	Bendamph ...	30·18	138
Westley.....	4·82	99	Seathwaite ...	30·11	82	Dunrobin	11·52	154
Brundall	4·18	87	Cardiff, Ely ...	8·80	90	Killarney ...	15·56	97
Alderbury	6·63	100	Haverfordwest	10·59	89	Waterford ...	9·45	95
Winterbourne ...	8·48	90	Gogerddan ...	12·02	122	Broadford.....	9·43	128
Torquay.....	7·59	89	Llandudno ...	7·20	111	Carlow	7·36	92
Polapit Tamar ...	9·87	108	Cargen	9·87	88	Dublin	5·38	90
Bath	5·11	78	Lilliesleaf	5·26	71	Mullingar.....	9·33	116
Stroud, Upfield...	5·84	91	Colmonell	11·09	98	Ballinasloe ...	8·15	97
Woolstaston	7·24	102	Glasgow	7·47	92	Clifden	19·74	101
Bromsgrove	4·65	95	Inveraray	21·97	133	Crossmolina ...	14·85	115
Boston	2·95	66	Islay, Eallabus	14·22	119	Seaforde	7·62	83
Hodsock Priory..	3·23	66	Mull	17·25	118	Londonderry..	10·06	108
Derby.....	3·98	78	Dundee	4·30	70	Omagh	10·50	126

All observers reporting for March showed rainfalls in excess of the average, except in the neighbourhood of Newcastle, and at many long-established stations the month was the wettest March on record. The percentage excesses were greatest in the south-west of England, the fall over the greater part of the country south-west of a line drawn from the Mersey to Beachy Head being more than twice and at some points approaching three times the average. Along the east coast and in the north of England the excess was smallest, not exceeding 25 per cent. The excess in Scotland averaged about 50 per cent., and more than twice the average amount of rain fell in the south and centre of Ireland. The result of such a wet month was a considerable reduction in the remarkable shortage of rainfall, on which we dwelt at length in our last issue, and for the first quarter of the current year it practically made up the deficiency of the two preceding months. The condition of things for 1905 was that in London and for a distance of 100 miles or so to the north-east and the south-west the rainfall for the three months was exactly the average. In North Wales, the north-west of Ireland, and especially in the north-west of Scotland, it was well above the average, and in the south-east of Ireland but little below. Along the east coast of Great Britain from the Wash to Montrose there was still a marked deficiency of rainfall, that part of the country having received less than three-quarters of the average amount, and in some parts of Northumberland and Durham not quite one-half.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE HOTTEST PORTIONS OF THE EMPIRE.

THE summary of the climatological records of the British Empire for the year 1903, published in "Symons's Meteorological Magazine," for 1904, and repeated in "Nature," for January 26th, 1905, conveys an erroneous idea as to the hottest places in the British Empire. It is pointed out that it is impossible to represent the average conditions of the climate of the Empire by so small a number of stations, but according to the figures given this doubtful honour appears to lie between Adelaide, in South Australia, and Coolgardie, in this State. Now as a matter of fact there are places in the Empire very much hotter than either of these, and it would perhaps give a more correct impression if one or two of such places were included. In this State, for example, Marble Bar, in the N.W. division, is very much hotter than Coolgardie. The *mean* of the daily maximum temperatures for last month was 109°·8, and the highest reading 120°·5. In the Eastern States there are, I believe, places with similar records. At Jacobabad, in India, the *average* daily maximum temperature is 111°·6 in May, 112°·7 in June, and 107°·8 in July. At Berber, in the Egyptian Sudan, the mean maxima for each month of 1902 were 102°·2, 102°·9, 113°·9, 112°·6, 108°·0, 109°·8, 109·2, 102°·7, 95°·5, and 91°·4; and the absolute maxima—109°·4, 114°·8, 116°·6, 116°·6, 113°·0, 116°·6, 111°·2, 109·4, 104°·9, and 95°·0. At Duem, in the same district, the mean maximum for March, 1902, was 114°·4, and the absolute maximum was 127°·4.

There may be hotter places still, but compared with these the temperatures at Adelaide and Coolgardie are mild, although high temperatures are occasionally registered during the prevalence of a "heat wave."

W. E. COOKE, *Govt. Astronomer.*

Perth Observatory, West Australia,
February 28th, 1905.

[We are sorry that an erroneous idea has been conveyed by our summary of the Climatology of the British Empire for 1903. We so clearly realize the tendency of the human mind to seize on deductions from a limited number of observations as if they expressed all truth, that we spend a considerable amount of space in each annual summary in beseeching our readers to bear in mind the small number of places represented in our pages, and the large number from which there are no records. On the occasion referred to above, fearing that some journalist might proclaim Coolgardie "the hottest place on earth," we followed the quotation of its maximum temperature by the caution—"It must be remembered, however, that we do not publish returns from any of the intensely

hot stations in the north-west of India." In previous years we have been prodigal in similar cautions. We shall try once more, when another annual summary is due, to discover some form of comprehensive repudiation of all possible misconceptions. We always welcome contributions from readers in the British Dominions beyond the seas, and would particularly value such an account of the Australian climate as was furnished in our volume for 1903 by Professor Stupart, for the Canadian climate.—ED. *S.M.M.*]

LONG PERIOD RAINFALL AVERAGES.

I NOTICE that you consider the thirty years' average of rainfall for 1870—1899 to be nearly the same as that for a much longer period.

Here I have compared it with the 87 years, 1818—1904 inclusive, and find that they compare wonderfully nearly, as the following table shows :—

Average Rainfall, Ross and neighbourhood.

	1818—1904 (87 years).		1870—1899 (30 years).
January	2·59		2·66
February	2·11		2·16
March	1·86		1·74
	— 6·56		— 6·56
April	2·05		1·95
May	2·14		2·10
June	2·28		2·27
	— 6·47		— 6·32
July	2·59		2·81
August	2·55		2·62
September	2·66		2·70
	— 7·80		— 8·13
October	3·17		3·09
November	2·87		2·95
December	2·65		2·47
	— 8·69		— 8·51
Year	29·52		29·52

Variation in Average Rainfalls.

			inches.
1818—1829	12 years.	Average	29·27
1830—1844	15 ,,	,,	31·62
1845—1859	15 ,,	,,	28·85
1860—1874	15 ,,	,,	28·46
1875—1889	15 ,,	,,	32·32
1890—1904	15 ,,	,,	26·57

My own observations are from January 1, 1859; Captain Pendergrass, F.R.Met.Soc., observed from 1818 to 1842; and Judge Herbert, a very careful observer, from 1852 to 1881; but I have given my own from 1859. Another gentleman, a few miles to the north of this, is responsible for the years 1843 to 1851, inclusive.

The year (365 days) ending March 7, 1905, gave only 17·07 in. of *rain at* this station, the lowest for any similar previous period—the

nearest being 1854–5, with 17·55 in. 1903–4, on the contrary, showed the largest amount registered—namely, 41·75 in. The lowest or smallest falls in any calendar years were—

1864	19·22 in.
1854	19·42 ,,
1870	20·18 ,,
1893	20·13 ,,

but on three occasions of 365 days, ending at different periods of the year, these records were much lower—

1854	16·48 in.
1864	16·48 ,,
1893	16·91 ,,

The following shows the periods when greatest deficits occurred—

	Days.	Rainfall.	Difference from Average, 1867—1897.
March 8 to July 18, 1904	133	5·22	—4·13
July 19 to Sept. 14, 1904	58	5·25	+ ·06
Sept. 15, 1904, to March 7, 1905	174	6·60	—8·86
	365	17·07	—12·93

Thus during what is normally the wettest part of the year, the difference was greatest, and consequently the effects on wells and springs proportionally greater.

In 1903 October gave 7·40 in., and in 1904 only ·55 in.—the one year yielding the absolute maximum recorded for the month, and the next year the absolute minimum.

H. SOUTHALL.

The Graig, Ross, Herefordshire,
April 3rd, 1905.

A PARALLEL CONTINUED.

YOU published in your February number, on page 6, some remarks from me on the resemblance between the Januaries of 1896 and 1905. I should like now to point out further that February and March of this year have continued to follow the pattern of 1896, with quite surprising closeness. February, 1st–25th, 1905, like February, 1896, had continuously high barometer, coupled with the calm and dryness that go naturally with high pressure, and also by a general mildness that does not usually accompany anti-cyclonic conditions at that time of year.

Again, February 26th—March 31st, 1905, like March, 1896, had a long series of depressions, some of them very deep, with violent gales, constant wind and rain, a most un-March-like prevalence of S.W. winds, and consequent mildness, noticeable absence of polar winds, and an unusual frequency of thunder and lightning.

Referring to back numbers of the Magazine, and examining the "Tables of Rainfall at 50 stations," which are published monthly, I notice for February, 1896, that every single station whose departure from a stated average is indicated by a + or a —, had in that

month a — sign. Also that in February, 1905, there is a very great preponderance of — signs. There is but one + for England (a small one in Yorkshire); one + for the extreme north of Ireland; and seven for the west and north of Scotland, some of which are evidently due to the break up of the anti-cyclone three or four days before the end of the calendar month. Again, the table for March, 1896, shews for England a + at all but two stations; and a considerable preponderance of + signs, both for Ireland and Scotland; and the March number in that year devotes half of page 38 to "Early Damage by Lightning in 1896," quoting instances of serious mischief done on March 4th, 16th, 24th, and 25th, in Jersey, Derbyshire, Yorkshire and Durham.

I am curious to see what comments upon this letter will be afforded by the records which you will be publishing along with it; but it would surely seem that for the first three months of 1896 and 1905, "the atmospheric conditions must have been *very similar* over a large area" (vide Mr. Bonacina's article on p. 7 of this volume); and it will be interesting to watch whether a dry April, and a still drier May, are going to keep up the parallel yet longer.

H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, Somerset, April 1st, 1905.

[The Table published this month fully bears out Mr. Boys's expectations, every sign but one is a +.]

THE THUNDERSTORMS OF MARCH 12th AND 15th.

On the 12th, thunder-clouds (cumulo-nimbus) were first observed in the S.W. at 3.15 p.m., moving with considerable rapidity in a N.E. direction. Thunder was first heard at 3.30 p.m.; at 3.35 p.m. a very vivid flash of fork lightning was seen due N., torrential rain commencing, along the whole of the northern sky-line enormous mist wreaths were visible hanging from the storm pallium; several further loud thunder claps and flashes of fork lightning were noticed; at 3.45 p.m., on the cessation of the rain, the wind increased in force to a whole gale from the W.S.W., and blew furiously for about fifteen minutes; by 3.50 p.m. the sky had partially cleared, with bright sunshine. During the ten minutes that rain fell—viz., from 3.35 p.m. to 3.45 p.m.—0·11 in. was registered.

On the evening of the 15th, the sky being entirely thick and overcast, but no definite cloud forms visible, at 10.30 p.m. a thunder storm broke lasting to 11.5 p.m., the most remarkable feature being the almost continuous and very vivid display of sheet and fork lightning, with practically speaking little thunder but torrents of rain and hail. Between 4 a.m. and 4.15 a.m., on the same date, a violent hail squall had been experienced, a very rapid rise in the barometer being noted at 4.10 a.m.; 0·05 in. in 6 minutes. I believe that hail falling during the hours of darkness is somewhat rare.

SPENCER C. RUSSELL.

Ashley Road, Epsom, March 25th, 1905.

THE LEGEND OF SAHARAN DUST FALLS.

WHEN the valiant Sir Francis Drake set forth, in 1577, on the famous buccaneering expedition during which he discovered Cape Horn, he carried a chaplain, the Rev. Francis Fletcher. This worthy man must have had a sore time of it—on one occasion his erratic master set him in irons on the quarter-deck with a parchment bound round his arm bearing the inscription, "frances fletcher y^{e} falsest knave y^{t} liveth"—but he was a faithful if somewhat credulous chronicler. In the narrative of the cruise, which he wrote under the title of 'The World Encompassed by Sir Francis Drake," Mr. Francis Fletcher gives the following account of a dust-storm in the Atlantic, with the explanation of the phenomenon as narrated by a Portuguese pilot, who, it would appear, was not devoid of a quaint sense of humour, and could spin as good a yarn as any land-lubber might wish to preserve in print. As no fall of Saharan dust has to be chronicled this spring, we give the old story, spelling and all :—

"After so long but a sweet pleasant travaile, before remembered, by the Providence of God we chanced and fell in the sight of Brasilia, where at the first the land seemed to make us a faire offer of opertunity to do that we had long desyred and now was most necessary for us, that is, to trim our shipps, being very fowle, for the land seemed to be verry pleasant, a fare bay, and a sandy ground, fitt for our purpose, and to encourage the rather, som of the people being in sight did show themselves very joyful to see us in drawing to stand inward towards their land : but the case was quickly altered, sweet meates would have sower sawce, and long delights was likely to have sower gaule and bitterness, for we had not longer held our way inward but the sight of land was taken from us, and that sodainly, with such a hasynes as if it had been a most deadly fogg, with the palpabel darkeness of Egypt, that never a shipp could see another. In the neck whereof did follow such extreame storms 'as heaven and earth had gon together, and the rootes of the rocks and the bottom of the sea should have been discovered, and that which was a signe of a desperat state to utter destruction, wee were upon a lee shore, and the shoales increased upon us. So that if the Portugall pilot had not ben apointed of God to do us good, we had perished without remembrance ; for he being well acquainted with the bloudy government of the Portugalls, was not ignorant of this part of countrye ; and knowing the present danger, he presently cryed a returne as we could, or els no way but iminent death, wherein, though we made all possible speed, yet one of our shipps touched with the shoales, but by God's Providence came cleere away, and being cast about to the seas, even against the streames, our fleet was so separated that in many monthes after we came not together againe. Now the pilot being in the Admiral, the question was whether he could give anny reason of so sodain an alteracion, and so extreame an accident to fall out against us in this place ; whose answer was, that such was the tyranny of the Portugalls towards the naturall inhabitants, that rather than they would endure their intollerable and bloody cruelty, they willingly exile themselves and banish themselves from their naturall soile and inheritances, to dwell in the far remote and

unfruitfull partes of the land, where being settled, the unmercifull and murthering Portugalls could not be contented with the fatt of their land, but they must pursue the poore and harmles people to root them out, their wives and children, from the face of the earth. Wherefore this people, which before did live by the instinct of nature, were now driven to yelde themselves into the hands of divells, and took them for their patrons and protectors against their bodily enemies the Portugalls, haveing them allwayes their familiars; who, when they see any shipps upon their coasts, the shoare being sandy, they cast the saud up in the ayre, whereof ariseth sodainly such a haziness as a most gross and thick fogg, that there followeth a palpable darkenes that the land cannot be seen, no nor the heavens; besides this, they hurle the sand into the heavens, which as they increast, so the shoales increast in the way of the shipps in the seas to ground them; and withall such horrible, fearful, and intollerable winds, raines, and stormes, that there is no certainty of life one moment of tyme, whereof we had present experience, and had perished, if God had not in His mercy and power prevented the same. By this meanes did they continually overthrow the Portugalls, when they came with their armies of men, and their *armathos*, that is, their huge shipps of warr, against them; whereof many had been cast away, and non that ever came in the dance did ever escape; and they supposing us to be Portugalls, and therefore their deadly enemies, being not acquainted with anny other people to frequent their land, they did practise against us as against them."

REVIEWS.

United States Geological Survey. *The Relation of Rainfall to Run-off*, by GEORGE W. RAFTER. Washington: 1903. Size 9 × 6. Pp. 104.

THE relation of rainfall to the flow of streams is here discussed somewhat fully, although hardly any definite conclusions seem to have been arrived at. In the words of the author:—

"No general formula is likely to be found expressing accurately the relation of rainfall to the run-off of streams, for streams vary widely in their behavior, and when they do agree the agreement is usually accidental. As a general proposition we may say that every stream is a law unto itself."

The writer is, however, greatly handicapped by the inadequate rainfall data available for the United States, and the unsatisfactory nature of many of the existing records. Streams are divided into classes with regard to the amount of rainfall, separating those in districts with exceptionally high evaporation, so that the relation may be roughly similar in each class, but it does not seem clear that this classification leads to any satisfactory result, and the author confines his remarks to detailing methods which he recommends should be avoided in any attempt to arrive at a solution of the problem.

The question of the effect of deforestization upon rainfall is likewise touched on, but abandoned for want of information. The paper, however, contains a large amount of detailed observational work *for particular* streams set forth in the form of diagrams.

Indian Meteorological Memoirs. Vol. XVII., Normal monthly and annual means of temperature, pressure, wind, humidity, cloud, rainfall, and number of rainy days of stations in India, by SIR JOHN ELIOT, F.R.S., K.C.I.E. Calcutta, 1904. Size $13\frac{1}{2} \times 10$. Pp. 288. Price 3 rupees.

THIS volume contains the normal data for the meteorology of India, a vast mine of statistics. The publications of the Indian meteorological department are in one way the worst in the world, not as to intrinsic merit, which is of the highest; but in the mode of forwarding the great quartos by post tightly rolled up and swathed in wrappings from which it is practically impossible to decorticate them uninjured, while to store the unrolled parts on a shelf is like trying to stow a set of compressed spiral springs into a drawer. This particular volume is not quite so springy as the rest, but it has touched the spring that lets forth our criticism like a meteorological jack-in-the-box.

Missions scientifiques pour la mesure d'un arc du méridien au Spitzberg enterprises en 1899-1902 sous les auspices des gouvernements Suédois et Russe. Mission Suédois, Tome II., Physique Terrestre VIII. section. Météorologie. Observations régulières à la station d'hivernage, par J. WESTMAN. Stockholm, 1904. Size $12\frac{1}{2} \times 10$. Pp. 222. Plates.

THIS volume contains the meteorological observations made at Treurenberg Bay in Spitzbergen in 1899 and 1900 by the Swedish men of science engaged in the joint determination of an arc of the meridian by the Swedish and Russian governments. The station was situated in 79° 55′ N.

On the Tension of Carbonic Acid in natural waters and especially in the sea. . . . The abnormal CO_2 percentage in the Air in Greenland and the general relations between Atmospheric and Oceanic Carbonic Acid, by AUGUST KROGH, Ph.D. Reprinted from *Meddelelser om Grönland*, vol. 26. Copenhagen, 1904. Size 9 × 6. Pp. 333-434.

THE author employs a new method to attack an old problem. He found the percentage of oxygen in the air in Greenland to be practically the same as in Europe, but the carbonic acid, instead of varying from 0·02 to 0·04 with an average of 0·03 per cent., as in all other parts of the world away from towns, was found to vary in Greenland from 0·025 to 0·07. The percentage was higher with northern and western winds, lower with eastern and southern. The suggestion put forward is that this may be due to the liberation of carbonic acid from solution in sea water in that part of the world.

RAINFALL AND TEMPERATURE, MARCH, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	3·00	+ 1·38	·58	15	21	60·9	22	27·0	4	2	12
II.	Tenterden ...	3·62	+ 1·73	·68	10	20	61·0	22	26·5	4	2	12
,,	Hartley Wintney ...	3·92	+ 2·15	·56	15	17	64·0	23	25·0	4	4	7
III.	Hitchin ...	2·81	+ 1·28	·40	15	24	60·0	21	26·0	3	3	...
,,	Winslow (Addington) ...	2·97	+ 1·35	·41	13	22	59·0	24	25·0	4	4	15
IV.	Bury St. Edmunds (Westley)	2·26	+ ·62	·32	14	20	61·0	22a	24·5	5	5	...
,,	Brundall ...	1·82	+ ·17	·27	10	21	60·0	22	24·0	4	3	11
V.	Alderbury ...	5·30	+ 3·52	·91	13	20	64·0	22	...	...	...	...
,,	Winterbourne Steepleton ...	6·27	+ 3·86	1·10	8	22	60·5	21	24·3	4	2	9
,,	Torquay (Cary Green) ...	5·33	+ 2·88	1·42	10	19	58·5	18	31·5	15	1	5
,,	Polapit Tamar [Launceston]	5·80	+ 3·39	1·20	10	24	60·0	21	24·0	3	4	9
,,	Bath ...	3·64	+ 1·70	·57	10	21	61·0	22	25·0	4	2	18
VI.	Stroud (Upfield) ...	4·36	+ 2·50	·57	10	23	64·0	28	30·0	3	1	...
,,	Church Stretton (Woolstaston)	5·19	+ 3·18	·67	15	22	58·0	22	31·0	2	3	...
,,	Bromsgrove (Stoke Reformatory)	3·38	+ 2·02	·45	23	19	59·0	22	23·0	3	6	...
VII.	Boston ...	1·60	+ ·24	·26	13	12	63·0	22	26·0	4	...	...
,,	Worksop (Hodsock Priory).	1·97	+ ·42	·39	28	19	60·5	24	27·0	20	6	22
,,	Derby (Midland Railway)...	2·51	+ 1·02	·37	10	23	60·0	22, 23	28·0	3	2	...
VIII.	Bolton (The Park) ...	3·81	+ ·93	·52	17	22	60·5	22	30·8	3	2	15
IX.	Wetherby (Ribston Hall) ...	2·27	+ ·42	·37	26	17	...	...	...	...	...	...
,,	Arncliffe Vicarage ...	5·70	+ ·67	·81	11	25	...	...	...	...	...	...
,,	Hull (Pearson Park) ...	2·05	+ ·26	·58	28	19	58·0	18, 28	30·0	19	3	24
X.	Newcastle (Town Moor) ...	1·35	— ·75	·42	25	13	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	11·10	+ ·59	1·59	11	23	59·5	22	27·9	3	2	...
XI.	Cardiff (Ely) ...	5·99	+ 3·20	1·27	10	23	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	6·06	+ 3·03	1·02	10	22	56·5	22	26·4	3	1	17
,,	Aberystwith (Gogerddan)..	6·23	+ 3·30	·70	27	22	67·0	22	19·0	2	5	...
,,	Llandudno ...	3·13	+ 1·16	·55	14	20	61·0	22	29·5	3	...	...
XII.	Cargen [Dumfries] ...	4·83	+ 1·82	·58	11	19	58·0	22	28·0	3	2	...
,,	Lilliesleaf (Riddell) ...	2·94	+ ·54	·60	25	25	53·0	23	24·0	19	6	15
XIII.	Edinburgh (Royal Observy.)	2·41	...	·57	25	19	61·1	22	33·1	3	0	19
XIV.	Colmonell ...	4·16	+ ·98	·85	23	22	57·0	22	29·0	2	3	...
XV.	Tighnabruaich ...	6·61	+ 2·25	·74	23	26	50·0	30	26·0	2	7	7
,,	Mull (Quinish) ...	7·93	+ 3·70	·71	20	26	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	3·15	+ 1·23	·80	25	21	54·0	19, 22	27·2	3	3	...
XVII.	Braemar ...	4·89	+ 2·47	1·27	15	22	53·0	22	16·4	3	11	...
,,	Aberdeen (Cranford) ...	3·56	+ 1·18	·89	25	20	53·0	31	27·0	2	9	...
,,	Cawdor (Budgate) ...	4·32	+ 2·16	1·40	11	19	...	...	...	...	...	...
XVIII.	Invergarry ...	6·88	+ 2·05	·90	15	24	...	...	...	...	...	...
,,	Bendamph ...	10·01	+ 3·63	1·08	11	27	...	...	...	...	...	...
XIX.	Dunrobin Castle ...	4·41	+ 1·94	1·58	11	17	55·5	31	30·0	10	2	...
,,	Castletown ...	3·77	...	·70	11	28	54·0	21	31·0	17, 18	2	...
XX.	Killarney ...	8·24	+ 4·21	1·22	23	28	59·0	22	31·0	24	...	...
,,	Waterford (Brook Lodge)...	5·58	+ 3·03	·81	14	25	57·0	22	25·0	3	8	...
,,	Broadford (Hurdlestown) ...	5·03	+ 2·86	·59	10	26	52·0	22, 26	26·0	2	6	...
XXI.	Carlow (Browne's Hill) ...	3·92	+ 1·66	·69	14	25	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	2·73	+ ·88	·70	14	20	61·4	22	29·7	3	1	8
XXII.	Ballinasloe ...	4·26	+ 1·81	·70	14	29	63·0	22	25·0	3	15	...
,,	Clifden (Kylemore House)..	8·58	+ 2·91	·90	24	24	...	...	...	...	...	...
XXIII.	Seaforde ...	4·07	+ 1·51	1·04	23	21	54·0	26, 27	27·0	2	7	28
,,	Londonderry (Creggan Res.)	3·20	+ ·14	·55	23	25	...	...	...	...	...	...
,,	Omagh (Edenfel) ...	5·22	+ 2·75	·50	14	29	58·0	22	30·0	2	7	14

+ Shows that the fall was above the average; — that it was below it. a—and 22, 24.

SUPPLEMENTARY RAINFALL, MARCH, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	4·20	XI.	New Radnor, Ednol	6·13
,,	Ramsgate, West Cliff	1·98	,,	Rhayader, Nantgwillt	8·76
,,	Hailsham	5·55	,,	Lake Vyrnwy	6·82
,,	Crowborough	5·09	,,	Ruthin, Plâs Dràw	3·30
,,	Osborne	5·24	,,	Criccieth, Talarvor	4·17
,,	Emsworth, Redlands	4·82	,,	Anglesey, Lligwy	3·98
,,	Alton, Ashdell	6·28	,,	Douglas, Woodville	4·28
,,	Newbury, Welford Park	5·77	XII.	Stoneykirk, Ardwell House	2·49
III.	Harrow Weald	3·30	,,	Dalry, Old Garroch	6·98
,,	Oxford, Magdalen College	2·69	,,	Langholm, Drove Road	5·86
,,	Banbury, Bloxham	3·05	,,	Moniaive, Maxwelton House	5·76
,,	Pitsford, Sedgebrook	2·35	XIII.	N. Esk Reservoir [Penicuick]	4·00
,,	Huntingdon, Brampton	2·08	XIV.	Maybole, Knockdon Farm	3·77
,,	Wisbech, Bank House	2·02	,,	Glasgow, Queen's Park	3·17
IV.	Southend	2·15	,,	Campbeltown, Redknowe	3·83
,,	Colchester, Lexden	1·81	XV.	Inveraray, Newtown	7·97
,,	Saffron Waldon, Newport	2·50	,,	Ballachulish House	11·11
,,	Rendlesham Hall	1·72	,,	Islay, Eallabus	5·62
,,	Swaffham	2·65	XVI.	Dollar	4·43
,,	Blakeney	2·06	,,	Loch Leven Sluices	4·29
V.	Bishops Cannings	4·28	,,	Balquhidder, Stronvar	8·48
,,	Ashburton, Druid House	9·17	,,	Coupar Angus Station	3·07
,,	Okehampton, Oaklands	7·31	,,	Blair Atholl	4·76
,,	Hartland Abbey	4·12	,,	Montrose, Sunnyside	3·64
,,	Lynmouth, Rock House	5·64	XVII.	Alford, Lynturk Manse	3·44
,,	Probus, Lamellyn	5·03	,,	Keith	4·13
,,	Wellington, The Avenue	4·88	XVIII.	N. Uist, Lochmaddy	6·25
,,	North Cadbury Rectory	3·44	,,	Aviemore, Alvey Manse	3·43
VI.	Clifton, Pembroke Road	4·74	,,	Loch Ness, Drumnadrochit.	3·09
,,	Moreton-in-Marsh, Longboro'	3·66	,,	Glencarron Lodge	...
,,	Ross, The Graig	3·41	,,	Fearn, Lower Pitkerrie	3·94
,,	Shifnal, Hatton Grange	3·30	XIX.	Invershin	4·38
,,	Wem Rectory	3·17	,,	Altnaharra	4·59
,,	Cheadle, The Heath House.	3·92	,,	Bettyhill	5·15
,,	Coventry, Kingswood	3·10	,,	Watten	3·12
VII.	Market Overton	2·53	XX.	Cork, Wellesley Terrace	6·82
,,	Market Rasen	2·32	,,	Darrynane Abbey	8·16
,,	Bawtry, Hesley Hall	1·80	,,	Glenam [Clonmel]	6·15
VIII.	Neston, Hinderton	2·62	,,	Ballingarry, Gurteen	4·39
,,	Southport, Hesketh Park	3·00	,,	Miltown Malbay	5·67
,,	Chatburn, Middlewood	3·15	XXI.	Gorey, Courtown House	4·48
,,	Cartmel, Flookburgh	3·02	,,	Moynalty, Westland	4·68
IX.	Langsett Moor, Up. Midhope	5·14	,,	Athlone, Twyford	4·42
,,	Scalby, Silverdale	2·38	,,	Mullingar, Belvedere	5·22
,,	Ingleby Greenhow	2·48	XXII.	Woodlawn	5·18
,,	Middleton, Mickleton	1·99	,,	Westport, Murrisk Abbey	6·43
X.	Beltingham	2·48	,,	Crossmolina, Enniscoe	6·52
,,	Font Reservoir, Fallowlees.	1·47	,,	Collooney, Markree Obsy	5·34
,,	Ilderton, Lilburn Cottage	1·81	XXIII.	Enniskillen, Portora	4·47
,,	Keswick, The Bank	5·79	,,	Warrenpoint	5·09
XI.	Llanfrechfa Grange	5·81	,,	Banbridge, Milltown	3·57
,,	Treherbert, Tyn-y-waun	11·39	,,	Belfast, Springfield	3·92
,,	Carmarthen, Friary	6·29	,,	Bushmills, Dundarave	2·99
,,	Castle Malgwyn	6·49	,,	Stewartstown	4·10
,,	Plynlimon	11·20	,,	Killybegs	4·55
,,	Tallyllyn	5·00	,,	Horn Head	3·80

METEOROLOGICAL NOTES ON MARCH, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Unsettled and rainy weather prevailed until 17th, with slight frosts in the first few days, and rough S. to W. winds during the second week. On 19th a change to more genial conditions took place and the latter part of the month was on the whole fine and dry. Duration of sunshine 86·0* hours and of R 67·0 hours. Mean temp. 45°·2, or 3°·1 above the average. Slight TS at 11 p.m. on 14th.

ABINGER HALL.—Stormy and wet, although R was much needed. Vegetation progressed fast with sunny days and warmer nights, but the ground was still cold. Short TSS on 11th and 18th.

TENTERDEN.—A warm and pleasant month, but very wet from 8th to 17th. High winds on 11th and 12th. Duration of sunshine 137† hours.

CROWBOROUGH.—A wet month, with more R than any March since 1870. Unusually mild, especially at night. A succession of gales, with occasional T, L and H, from 7 p.m. on 10th to the evening of 15th. Except on 3rd the month was entirely free from frost. Mean temp. 43°·3.

OSBORNE.—The wettest March for at least 47 years, the R being 3·40 in. above the average for that period.

HARTLEY WINTNEY.—The first two weeks were squally and tempestuous, with much R and T, making the wettest fortnight yet recorded here and also the wettest March. The latter part was drier, with absence of frost. Ozone every day, with a mean of 4·6. S.W. gales on 10th and 11th.

COLCHESTER.—Mild, with little E. wind and frequent showers. Several bright and warm days and everything looking well. Short but sharp TS on 14th, during which some houses were damaged.

TORQUAY.—Mean temp. 46°·4, or 2°·3 above the average. Duration of sunshine 153·9* hours, or 15·6 hours above the average. Mean amount of ozone 5·8.

ASHBURTON.—TSS on 11th and 14th, that on 14th consisting of a continuous series of flashes of L from midnight to 5 a.m. with torrents of R.

POLAPIT TAMAR.—Very wet, with a rough and stormy period from 9th to 16th. The total R was the largest for March for 36 years, except in 1903.

LYNMOUTH.—The wettest March since 1878, except 1903, when 7·30 in. of R fell. R 2·74 in. above the average. Much bright sunshine in the last 10 days. L on 11th and 20th.

WELLINGTON.—A great change from many previous months, the R during the first 17 days being exceedingly heavy, and the total for the month about double the normal. Very violent winds at times. TS on 15th, with H.

NORTH CADBURY.—Except on the first three days there were no polar winds and frosts were few and slight. The R, though much wanted, interfered with sowing. The worst gale of the winter occurred between 8 p.m. on 14th and noon on 15th. Trees were felled and a church window was blown in.

CLIFTON.—Wild weather from 10th to 17th, with a succession of gales and heavy R. The rest of the month was unsettled, with frequent showers. R exactly double the average and the greatest since 1867. TSS on 3 days and H on 4.

STROUD.—On 11th, during a furious H storm, between 6.30 and 7 a.m., an elm and a poplar were struck by L, about a mile from here. On 14th an elm was blown down in a S.W. gale. T, L and H on 7th.

ROSS.—Very warm, with fewer, and less severe, frosts than usual. The period of 365 days ending on March 7th gave 17·07 in. of R, against 41·75 in. in the year immediately preceding. The former was the smallest similar total in 87 years, whilst the latter was only exceeded two or three times.

BOLTON.—Remarkably bright, only two days being sunless. Total duration

82·3* hours, or 2·8 hours above the average Mean temp. 43°·0, or 3°·6 above tho average, and only once exceeded since observations commenced in 1887. The season was consequently very forward. Mean amount of ozone 2·0, being ·5 above the average. T on 4 days and L on 2.

LILBURN.—Changeable, with frequent showers, but fine on the whole. Vegetation forward.

HAVERFORDWEST. — Stormy and wet, especially on 15th, when much damage was done. Mild generally, with a good deal of sunshine. Agricultural operations were well advanced and vegetation forward. Duration of sunshine 128·9* hours.

DOUGLAS.—Wet and generally mild, with much wind. An extremely severe W. gale on 15th did much damage. From 17th to 23rd was fine and spring-like, and vegetation was not backward at the end. H, S, L and T on 9th. Hills covered with S for some days from 24th.

SCOTLAND.

LANGHOLM.—R 1·60 in. above the average of 29 years.

LILLIESLEAF.—Very windy, with continuous and sometimes heavy showers. "Summer all day, winter each night," the min. temp. keeping near freezing point.

COLMONELL.—Strong winds or gales on 3rd, 10th, and 13th to 15th, and very frequent but seldom heavy R. Mean temp. 42°·9, or 2°·3 above the average

INVERARAY.—Wet and stormy, with R chiefly in heavy showers, and a good deal of H. Too wet for sowing and the usual March work.

COUPAR ANGUS.—Mean temp. almost 3° above the average. R nearly an inch above the average, this being the first month with a surplus since August, 1904. Frost on 10 mornings.

DRUMNADROCHIT.—R ·11 in., and rainy days 3, above the average. Remarkable absence of frost.

CASTLETOWN.—Cold and continuously wet until 18th. Latter part warmer, but still very wet. The ground was too wet for farmers to complete ploughing, and no cereal seed was in by the end.

IRELAND.

CORK.—The wettest March for at least 27 years, the R being nearly three times the average. Great storm on 14th and 15th, in which the bar. fell to 28·14 in. L on 11th and 14th.

DARRYNANE ABBEY.—A great contrast to the two previous months, the R being 4·85 in. more than the average of 25 years, and 1·91 in. more than the next heaviest fall in that period.

MILTOWN MALBAY.—Cold, wet, stormy and squally, with T, L and H. All tillage work stopped.

DUBLIN.—Unsettled, squally and showery, with S.W. and W. winds. Mean temp. 45°·2, or 1°·6 above the average, Duration of sunshine 159* hours. H on 9 days. On 15th, at 5 a.m., the bar. fell to 28·077 in., the lowest pressure since December 8th, 1886, when 27·758 in. was recorded.

MARKREE OBSERVATORY.—R, H, sleet and some S fell frequently till 17th, with high winds and gales at times. Fine and showery after, and generally mild.

OMAGH.—It would be difficult to find in the record a more unfavourable March for agricultural purposes. The ground became entirely unfit to receive seed of any kind, and no sowing seems to have been attempted in any part of the country.

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* Campbell-Stokes. † Jordan

Climatological Table for the British Empire, October, 1904.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	67·1	18	32·7	15	57·7	44·7	47·9	90	98·7	22·9	1·56	11	6·3
Malta	81·7	8	53·7	10	72·8	61·8	59·8	80	133·8	48·3	6·34	15	4·6
Lagos	86·0	25*a*	70·0	13*c*	84·0	73·7	72·8	77	148·0	68·5	6·37	12	7·2
Cape Town	93·0	30	41·6	12	67·2	52·5	51·9	74	...	...	2·83	10	5·4
Durban, Natal	96·1	23	53·3	16	77·0	61·6	...	...	159·2	...	2·52	19	5·2
Johannesburg	82·5	6	37·8	13	72·9	50·8	41·3	57	...	35·8	·79	7	3·7
Mauritius	87·1	31	54·6	10	80·4	64·0	61·4	71	149·6	46·9	·93	13	6·7
Calcutta	92·4	1	63·1	27	88·0	73·4	72·2	77	155·8	57·4	·98	3	4·6
Bombay	93·1	4	75·1	21	89·3	77·6	75·1	77	141·1	66·8	·56	4	3·4
Madras	94·5	4	67·3	29	90·2	74·7	72·7	78	146·5	63·9	2·33	15	5·2
Kodaikanal	67·2	19	45·3	31	62·2	51·1	51·2	86	135·8	41·9	12·29	20	6·4
Colombo, Ceylon	87·6	2	72·0	5*d*	85·5	75·1	71·6	79	154·6	68·0	21·73	24	5·7
Hongkong	85·1	2	67·4	31	80·1	73·3	49·6	74	137·0	...	2·01	8	5·8
Melbourne	88·7	31	38·2	3	68·1	48·9	47·8	72	147·9	31·0	2·72	11	5·0
Adelaide	95·7	18	43·6	7	73·4	52·7	48·0	60	149·0	39·5	2·11	13	5·2
Coolgardie	94·2	30	38·4	9	71·9	49·5	44·7	55	159·1	35·7	1·87	10	4·8
Sydney	86·4	30	43·9	1	71·4	56·0	51·7	67	125·0	36·3	2·33	17	4·5
Wellington	66·2	31	39·9	13	57·4	46·4	43·7	74	127·0	37·0	12·91	17	7·4
Auckland	67·0	24*b*	44·0	8	61·0	50·0	47·5	75	137·0	39·0	3·80	17	5·8
Jamaica, Negril Point	87·9	8,12	70·9	5*e*	85·1	73·6	75·5	86	...	...	5·07	11	...
Grenada	91·4	31	73·2	8	85·6	75·0	71·8	73	156·2	...	1·57	16	3·0
Toronto	71·0	10	23·0	31	54·2	37·8	39·9	78	98·2	16·8	2·48	11	6·1
Fredericton	67·8	21	19·9	28	53·5	34·2	30·9	58	...	...	2·81	9	5·8
Winnipeg	66·0	16	20·7	6	51·8	33·3	...	...	...	...	1·51	12	6·9
Victoria, B.C.	66·2	2	40·2	28	57·5	47·9	...	...	...	...	·88	8	7·1
Dawson	55·0	10	8·2	23	36·5	21·3	...	...	...	...	·36	3	4·2
Lagos (July)	84·0	9	69·0	26	80·9	72·7	71·6	82	140·0	65·0	12·27	14	8·0
,, (August)	85·0	26	69·0	5	82·1	72·3	69·6	75	141·0	65·0	·03	2	7·7
,, (September)	87·5	4	70·5	18	83·3	73·2	72·6	80	148·0	66·0	7·06	20	8·2

a—and 26. *b*—and 25. *c*—and 28. *d*—and 21, 26. *e*—and other days.

MALTA.—Mean temp. of air 66°·3, or 3°·1 below average, mean hourly velocity of wind 8·2 miles, or 0·6 below average. Mean temp. of sea 73°·9. T88 on 3 days.

Mauritius.—Mean temp. of air 0°·5, dew point 0°·4, and rainfall ·63 in., below averages. Mean hourly velocity of wind 9·4 miles, or 1·6 miles below average.

KODAIKANAL.—Bright sunshine 149 hours.

COLOMBO.—Mean temp. of air 80°·0, or 0°·2 below, of dew point 1°·4 below, and R 7·27 in. above, averages. Mean hourly velocity of wind 6·1 miles; prevailing direction S.W.

HONGKONG.—Mean temp. of air 76°·5. Bright sunshine 191·2 hours. Mean hourly velocity of wind 14·1 miles; mean direction E. 11° N.

Adelaide.—Mean temp. of air 63°·0, or 0°·9 above, and R ·39 in. above, averages.

Sydney.—Mean temp. of air 0°·2, above, R ·65 in. below, and humidity 1·4 p.c. *below* averages.

Wellington.—Mean temp. of air 2°·3 below, and R 9·01 in. above, averages.

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NEW SCHEME FOR THE ADVANCEMENT OF METEOROLOGICAL KNOWLEDGE.

The Council of the Royal Meteorological Society has been for some time past engaged upon a scheme for the advancement of the general knowledge of Meteorology and the promotion of that larger measure of public interest in the science which its very close connection with many of the other sciences and the phenomena of everyday life undoubtedly merits.

The Council, considering that the object in view can be largely attained with the co-operation of the various scientific societies and institutions scattered over the country, is arranging for a series of lectures to be given in connection with them. These lectures will be delivered by lecturers appointed by the Council itself and will be drawn up in accordance with the Council's approved programme. They will, it is understood, be of a practical character and in many cases illustrated by lantern slides, of which the Royal Meteorological Society has a large and comprehensive collection. Various societies and institutions frequently hold scientific exhibitions and the Council is making provision for a series of exhibits for these, illustrative of the methods of taking meteorological observations and of the instruments generally used. The exhibits will be in charge of a representative of the Society, who will be prepared to explain them and their use.

It is expected that such lectures and exhibitions will lead to an increased appreciation of the importance of an accurate knowledge of weather conditions and the elements of climate, and to the establishment of new observing stations under the auspices of the Royal Meteorological Society, thus meeting a frequently expressed wish for authoritative information and guidance upon meteorological subjects, which the Society is eminently fitted to give.

The Council has always attached great importance to the intimate connection of Meteorology with Agriculture, and recognising the special and public benefit which a proper appreciation of this would confer, it has included in its scheme the arrangement of exhibits

such as are referred to above, and others bearing directly on the relations between the two sciences, in the Shows of the various agricultural societies, and it is believed that such an exhibit has been arranged for at this year's meeting of the Royal Agricultural Society at Park Royal. In pursuance also of this part of the scheme the Council has approached the authorities in charge of the Agricultural Education in Elementary Schools Bill, now before Parliament, with a view to the inclusion of Meteorology and Weather Study with the subjects proposed to be taught in such schools.

The scheme is, of course, in its initial stages at present, but it has already received a considerable measure of support, and the Council will be prepared to extend the series of lectures and exhibits, where feasible, to, *e.g.*, the great Public Schools, Private and Elementary Schools, Polytechnics and (the camera in skilled hands being a valuable aid as a means of cloud recording) Photographic Societies.

The scheme as thus far noticed provides for bringing meteorological knowledge to the societies and institutions' own doors, so to speak, but it is also intended by the Council of the Royal Meteorological Society to hold conferences in London, from time to time, to which representatives from the various societies shall be invited and papers dealing with Meteorology and its practical uses shall be read and discussed, and exhibitions illustrating the science in all its branches and open to the general public in connection with the conferences, will be held.

The present time of year, when the scientific societies and institutions are in full work, is, it is believed, being chosen for putting the scheme into operation, and it is to be hoped that in many cases advantage will be taken by the societies of its provisions for their next session, and that Fellows of the Royal Meteorological Society who are also members of local societies will assist the Council in the necessary arrangements and in thus extending the already wide sphere of the Society's operations.

SCOTTISH METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on March 16th, in Dowell's Rooms, Edinburgh, Sir John Murray, K.C.B., F.R.S., in the chair.

The report from the Council was adopted, and Mr. Ralph Richardson, W.S., appointed to the vacancy on the Council caused by the resignation of Professor Copeland.

Mr. E. M. Wedderburn, read a paper on "The Temperature Changes of the Surface Waters of Loch Ness." He described the instruments used and the methods adopted in the Survey of the Scottish lochs, at present in progress under the direction of Sir John Murray and Mr. Laurence Pullar. During the summers of 1903 and 1904 attention had been largely concentrated on Loch Ness and some important general conclusions from the temperature observations there had already been published by Mr. E. R. Watson. (*Geographical*

Journal, October, 1904.) The story of the investigation of temperature on the surface and at small depths was one of doubts and difficulties. They had not yet got a satisfactory instrument for accurately recording rapid variations, and the surface temperatures had been known to change as much as 6° F. in two minutes. The observations, however, clearly showed that in calm summer weather on Loch Ness a diurnal change of temperature due to solar radiation was well marked at the surface, fairly distinct at a depth of 10 feet, and non-existent at a depth of 25 feet. A set of simple observations made in May, 1904, at a depth of 5 feet, showed that between 8 p.m. and 10 p.m. abrupt change of temperature took place at that depth, followed by numerous rapid variations: the water at 5 feet got warmer, probably owing to the upper layers having cooled down with a consequent condition of unstable equilibrium giving rise to energetic convection currents. It was very difficult to investigate the surface temperature changes on account of the numerous currents and the variations produced by sudden shifts of wind.

Professor Knott read the second paper, on "Solar Radiation," and gave an account of researches he had made on this subject in relation to earth temperatures and sea temperatures. An analysis had been made of the records given by the thermometers placed by Professor Forbes in 1837 in the rock of the Calton Hill, Edinburgh, and the average amount of heat gained or lost from month to month had been calculated. The accumulated heat had a zero value at the beginning of March and its maximum at the beginning of September, by which time about 1200 units of heat had been stored under each unit of area of the rock surface. Determining next the amount of energy supplied by solar radiation, Langley's estimates had been adopted, from which it appeared that in the latitude of Edinburgh 114,800 units of energy per unit area were supplied during the summer half-year (April to September), but only 19,080 units during the winter half-year. But the Calton observations had shown that only 1200 units of heat were stored in the rock in the summer half-year—*i.e.*, only about 1 per cent. of the energy radiated by the sun and reaching the Earth was accumulated as heat, the remaining 99 per cent. being radiated or reflected. Of course, Langley's estimates of the solar constant had been made in a very different climate from that of Edinburgh, where a much larger proportion of the sun's rays were intercepted by clouds. It was remarkable, however, that observations made at the Radcliffe Observatory down to the depth of 9½ feet, to which the Oxford gravel extends, led to a conclusion almost the same as did the Calton records.

As regards solar radiation and sea temperature, observations made by the Austrian war-ship *Pola* showed that, at all events in the Levant in September, 1892, about two-thirds of the solar energy incident on the surface was utilized by the water near the surface and that the heating effect penetrated to a depth of about 20 metres. At lower depths conduction was probably the most powerful agent

of heat distribution. It was easy to see, however, that towards the surface convective movements would be the chief factor, since the surface layers owing to evaporation and consequent increase of salinity might rapidly become denser than the slightly cooler layers below and in sinking convey heat from the surface downwards.

An interesting discussion followed, in which Sir John Murray and Dr. Buchan took part.

METEOROLOGICAL AVERAGES AND EXTREMES AT WELLINGTON, NEW ZEALAND.

The Rev. D. C. Bates, of the Meteorological Office, Wellington, sends the following valuable series of average and extreme values for the principal meteorological elements as the results of 40 years' observations at the Wellington Meteorological Observatory.

Barometer.

Mean 29·934 in. Highest 30·886 in. on 30 August, 1889.
Range 2·300 in. Lowest 28·586 in. on 6 March, 1871.

Air Temperature in Shade.

Mean 55·3° F.; absolute max. 88° F.; absolute min. 30° F.

Rainfall.

Mean annual fall .... 50·75 in.
Max. ,, ,, in 1892 ..... 67·65 in.
Min. ,, ,, in 1889 ..... 31·35 in.
Max. fall in any single month, December, 1884 ..... 12·45 in.
Min. ,, ,, ,, February, 1880 ..... 0·13 in.
Max. fall in a single day, 11th March, 1893 ..... 5·70 in.
Average number of days when rain (·01) fell, 170.

Average Monthly Rainfall, 1865-1903.

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
3·60	3·25	3·10	4·15	4·61	4·94	5·86	4·94	4·22	3·93	3·57	3·26

Mean Monthly Temperatures.

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
62·8	62·4	60·5	56·9	52·8	49·5	47·6	48·5	51·5	54·3	57·0	60·6

Mean Monthly Velocities of Wind (38 years), in miles per day.

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
234	218	211	201	198	177	179	197	220	264	241	247

Mean velocity 216 miles per day.
Max. daily velocity 960 miles 22nd October, 1869.

Mean Barometer (40 years).

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
29·893	29·966	30·024	30·053	29·950	29·953	29·898	29·933	29·922	29·884	29·869	29·865

Mean relative humidity 75·3 per cent. of saturation.
Mean Temperature of Dew Point 47°·6 F

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, April 19th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. W. H. Dines, F.R.S., gave "An Account of the Observations at Crinan in 1904, and Description of a new Meteorograph for use with Kites." These observations, which have been carried out under the direction of a joint Committee of the Royal Meteorological Society and of the British Association, are made with meteorographs attached to kites with the object of ascertaining the conditions prevailing in the upper atmosphere. During last summer the kites were flown from the deck of H.M.S. *Seahorse*, which was placed at the disposal of the Committee by the Admiralty. Mr. Dines designed a new and inexpensive meteorograph, which he now fully described. (See this Magazine, Vol. **39**, p. 109). The weather conditions of last summer were somewhat unusual, there being a decided preponderance of east and south-east winds. Near the summit of Ben Nevis the air was often dry, and was on several occasions warmer than the air at the same level at Crinan. As a rule, however, the temperature on Ben Nevis is generally much lower than the temperature in the free air at the same level. On several occasions temperature inversions were observed at levels between 3000 and 7000 feet. A fact previously noticed was again observed—viz., the decrease of strength of easterly winds with elevation.

The President, Mr. R. Inwards, Dr. W. N. Shaw, F.R.S., Mr. J. E. Clark, Mr. R. H. Curtis, Mr. F. Gaster, and Mr. W. Marriott took part in the discussion, and all spoke favourably of the new meteorograph.

Dr. H. R. Mill read a paper on the "Rate of Fall of Rain at Seathwaite." This is a discussion of the records from a Negretti and Zambra self-recording rain gauge during a period of eighteen months, July, 1899, to December, 1900. Seathwaite, which is in Borrowdale, Cumberland, is one of the wettest spots in the British Isles, and so these continuous records, though of short duration, possess exceptional interest and value. Dr. Mill compared the readings at Seathwaite with those at Camden Square, with the following results :—

Rate of Fall of Rain from July 10, 1899, to December 31, 1900.

	No. of Rainy Days.	Hours of Rain.	Inches of Rain.	Rate Per Rainy Day. in.	Rate Per Hour. in.	Hours per Rainy Day.
Seathwaite.....	350	1695	182·91	·523	·108	4¾
Camden Square...	196	484	32·15	·164	·066	2½
Ratio of Seathwaite if Camden Square =100...	179	350	569	319	164	190

This shows that the total duration of rain at Seathwaite was three times as long as in London, the amount falling six times as great and the rate of fall consequently twice as rapid.

At Seathwaite there were altogether 88 showers with more than half-an-inch of rain in the 539 days under consideration, an average of rather more than one per week. Of these 45 produced less than an inch of rain, and only 13 more than 2 inches. The mean duration of such a shower was 8 hours, the greatest 30 hours, and the least 1¾ hours. The showers yielding less than 1 inch had a mean duration of 6 hours and a mean rate of fall of ·14 in. per hour, though with a great range. The showers yielding larger amounts were proportionally shorter, for although the mean duration was 7½ to 20 hours, the mean rate was either ·20 in. or ·22 in. per hour, showing that at Seathwaite the long-continued rains are on the whole the heavier. The largest amount which fell in one continuous shower was 4·03 in. and this also gave the greatest duration, for while it was falling the rain did not cease for 30 hours. Dr. Mill's results seem to show that the rainfall at Seathwaite in an average year shows a tendency to be greater during the hours of darkness than in daylight, that rather less than half the time during which rain is falling it continues without intermission for at least six hours at a time, and that rather more than half the total amount of rain is deposited in such long showers.

The President, Mr. J. Hopkinson, Mr. W. Marriott, Mr. R. H. Hooker, Mr. W. B. Tripp, Mr. F. Campbell Bayard, Mr. Baldwin Latham, and Mr. J. E. Clark took part in the discussion, and Dr. Mill replied.

The following gentlemen were elected Fellows of the Society :— Dr. E. P. Allis, Capt. C. B. Andersson, Mr. J. Aspinall, Mr. J. Burtt Davy, F.L.S., Mr. H. E. Frick, Mr. A. E. Hayter, Mr. S. C. Russell, Mr. G. C. Simpson, B.Sc., Capt. H. M. Walker, Capt. G. S. Webster, and Mr. H. D. Williamson.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WAS IT GLOBE LIGHTNING?

It would be interesting if some of your readers in Richmond could give any further information as to the circumstances described in the following paragraph from the *Surrey Advertiser*, of April 22nd.

An alarming phenomenon was witnessed at Richmond during a thunderstorm on Sunday afternoon. Following a blinding flash of lightning about three o'clock what appeared to be a ball of fire was seen descending. It seemed to explode just over St. Matthias' Church, in Church Road. A hole was torn in the roof and the place was for a second flooded with flaming light. The church is lighted with electricity, and the storm current came into contact with the electric wires. The glass doors of the various electric switchboards were simultaneously blown outwards and smashed to pieces.

These unusual occurrences had a terrifying effect upon several hundred children who were present, but nothing more serious happening, they were gradually reassured, though the service was abandoned.

J. P. MACLEAR.

Chiddingford, 22nd April, 1905.

THE COLD WINTER IN INDIA.

SIR JOSEPH HOOKER, G.C.S.I., F.R.S., has kindly forwarded the following interesting extracts from a letter:—

We are having glorious weather still, in fact it is absolutely abnormal. In all the 60 years that Mr. Chrestien can remember of India there has never been such extraordinary weather as there has been ever since Christmas. From the middle of January till the middle of February we had a succession of cold, dismal, cloudy, rainy days; regular English weather. We wore our thickest clothes, and shivered in the middle of the day, and at night, if we were somewhere where there was a fireplace, we sat before a wood-fire, if not, native fashion, we sat with pots of burning charcoal between our feet. All through we had slight frosts at night; during two nights, early in February, it was so severe that in places one could see nothing but dead, brown leaves on the trees. Riding along the valleys of the Government Reserved Forest, one passed nothing but frost-bitten trees with not a green leaf on them. Up on the slopes the trees were untouched, but in the open acres of crops were ruined, especially castor-oil, gram and Rahur (a Dahl), and one saw huge banyan and mango trees one mass of dead, brown leaves. From the middle of February we had the cold weather we ought to have had before, and we have had glorious weather ever since. Usually at this time one lives under a punkah, in the lightest of clothes. But I still shut the doors to keep warm, and at night I am none too warm under a blanket and a rug, with the doors shut.

HUGH HANNAY.

Camp Dhab, Hazaribagh, Bengal, 3rd April, 1905.

THE CLIMATOLOGICAL TABLE.

AS a subscriber to your Magazine for many years, I am taking the liberty to write to you with regard to the Climatological Table for the British Empire. I have been of the opinion for a very long time that it would be more interesting and instructive if you could publish a more representative table than one restricted to the British Empire. Observations from the United States would be of interest to compare with the numerous ones from Canada; Egypt to compare with South Africa; Japan, China and Siberia should also be there. Surely observations can be obtained without difficulty from these parts, at any rate they can be had from Europe and the States. I do not like to see the term British Empire applied to any scientific observation—what must our foreign readers think of it?

Science should know no boundary, no territory, but consider all the world equal. Perhaps, if you can find room for this letter, other meteorologists would give their views on this subject.

J. A. SARGENT.

Bancroft, Hitchin, April 20th, 1905.

[We are entirely in sympathy with Mr. Sargent's principle that science should not be cramped by political boundaries, and were it possible to find space for a larger Table each month we would gladly appeal, and we are sure we should not appeal in vain, to the directors of representative meteorological observatories in the United States, the various countries of Europe and the colonial possessions of other nations. But we must remind our readers that the space is not available. The Magazine is already too large for its price though too small to admit of another page being diverted from letterpress to statistical matter. The remedy lies with our readers; if they care to increase the circulation of the Magazine, we will follow by increasing the size, and one of the first improvements would be to move in the direction suggested in the foregoing letter. It is always helpful to have the opinion of readers on matters that interest them, and we would gladly see what others think on the question thus raised.—ED. *S.M.M.*]

RETURN OF WINTRY WEATHER, APRIL, 1905.

SOME correspondents of the daily papers seem to be under some apprehension that this wintry weather, lately experienced, is quite uncommon and unseasonable, according to ideas of the time of year.

On looking over my diary for the last six years, I find that snow storms appeared in Edinburgh on April 16th and 17th, 1899; again in 1900, March 27th and 28th; again on March 9th and 10th, 1901. Snow was recorded on April 3rd, 1902 and 1903; April 11th, 12th, 13th, 14th and 21st, 1904; and on April 9th and 10th, 1905, on April 7th and 8th.

The east coast of Scotland, including Edinburgh, probably has to submit to a *second winter* after its own is concluded in March with the equinoctial gales. This is brought about by the cold airs and currents drifting from the Baltic Sea, on the melting of the snows and glaciers in Scandinavia.

The same state of things happens to the west coast by the icebergs from Greenland and Davis Straits, sailing down the Atlantic Ocean, and gradually melting away in low latitudes, such as the latitude of Britain; but the phenomena on the west coast are modified or interrupted by the Gulf Stream which prevents any coldness of air or water from being so permanent as on the east coast at this time of the year.

I may express the likelihood that we may get a cold week in May, as usually happens, much to the surprise of the correspondents referred to, who think that one swallow makes a summer if a fine day occurs.

W. G. BLACK, F.R.MET.SOC., F.R.C.S.E.

Edinburgh, April 30th, 1905

REVIEWS.

Cape of Good Hope.—Report of the Meteorological Commission for the year 1903. Cape Town, 1904. Size 12½ × 8. Pp. 198. *Plates.*

THE work of this Commission continues to show a splendid return for the money spent upon it, though the difficulties under which it is carried on are far greater than those against which the Meteorological Offices of European countries have to contend. A decrease in the number of rain observing stations is attributed, in part, to the severe drought which prevailed over two-thirds of Cape Colony, compelling many of the farmers in the Karoo to trek with the remainder of their cattle to adjoining territories, leaving their homesteads entirely unoccupied and, naturally, the rain gauges untended. The interest shown in meteorology by the people of Cape Colony is attested by the fact that numerous applications for instruments are received every year, many from persons situated in most suitable positions; but, unfortunately, these cannot be granted, except in a very few cases, on account of lack of funds. It is amazing to find that the great mass of work epitomised in this volume is carried out on a government grant of £800 per annum. In a country so dependent as Cape Colony is on a knowledge of the climatic conditions, the policy of starving so vital a department comes dangerously near to "spoiling the ship for want of a ha'porth of tar."

The Cyclones of the Far East. By REV. JOSÉ ALGUÉ, S.J. Second (revised) edition. Manila, 1904. Size 11½ × 9½. P. 284.

THE learned director of the Philippine Weather Bureau has written so complete and detailed a treatise on the whole subject of tropical cyclones, and especially of the terrible typhoons which are of constant occurrence in the neighbourhood of the Philippines and of the China Seas, that any attempt to make a synopsis of the work would be an impossibility in the limited space at our disposal.

After describing at length the origin, structure, movements and laws of typhoons and discussing their frequency and classification, the author gives an account of the attendant phenomena, meteorological and otherwise, and various direct and indirect precursory signs of their occurrence.

In the latter part of the volume typical typhoons are minutely described as confirmatory evidence of the information given in the earlier part. There are also a number of notes of practical interest to sailors and a list of harbours which afford refuge in case of an encounter with a typhoon. The volume is profusely illustrated with maps, diagrams and photographs of instruments.

Taken altogether, this is an able compendium of the life-work of an acknowledged master of the subject, and takes its place as a standard work on Tropical Meteorology.

The Climate of the Philippines. By Rev. José Algué, S.J. Bulletin 2 of the Census of the Philippine Islands. [No place of publication.] 1904. Size 9 × 6. Pp. 104.

The subject is divided into sections, dealing respectively with temperature, water vapour (including rainfall) and the movements of the atmosphere, and each section is profusely illustrated by diagrams representing the distribution and frequency of the various phenomena. There are also coloured maps of the mean annual temperature and rainfall of the Islands.

Temperature and rainfall observations are quoted from a considerable number of stations, but generally for a very limited period, and by far the greater part of the results are deduced from the splendid records maintained at the Manila Observatory.

In the sub-section dealing with rainfall appears a list of instances of tropical falls of rain in periods of an hour or less, as measured by the Casella recording rain gauge at the Observatory, from which we select the following extreme cases:—

May 21st, 1892,	60 m.m.	(2·36 in.)	in 30 minutes.
June 15th, 1891,	50 ,,	(1·97 in.)	in 8 ,,
August 6th, 1889,	50 ,,	(1·97 in.)	in 7 ,,

The last mentioned fall was at the rate of 16·88 in. per hour. On six occasions in the period from 1865 to 1902 inclusive, daily falls exceeding 200 m.m. (nearly 8·00 in.) took place, of which the most notable were 336·0 m.m. (13·23 in.) on September 24th, 1867, and 290·1 m.m. (11·42 in.) on July 30th, 1880.

METEOROLOGICAL NEWS AND NOTES.

The International Meteorological Committee will meet at Innsbruck, in Tyrol, on September 9th, and representative meteorologists from all countries have been invited to take part in the proceedings. A provisional programme has been drawn up and circulated by Professor Hildebrandsson. Amongst the questions put forward for discussion are suggestions for improving observations which may be used for the comparison of phenomena over wide areas, especially with regard to noting the exact time of observing each instrument, reducing observations to standard conditions, and the like. Attention is to be called to the very important question of the causes and the prognostics of widespread heavy rains, the importance of which as affecting floods is naturally felt much more on the continent than in our country of mild extremes. Professor Pernter is to suggest a more precise classification of meteorological stations according to the equipment and the nature of the observations carried on. The question of the possibility of extending the use of wireless telegraphy for obtaining reports from the eastern Atlantic, and many others on which an international understanding is desirable, will be taken up.

MR. R. C. MOSSMAN has returned to this country in excellent health, after a sojourn of two years in charge of the meteorological observatory established in a sub-Antarctic island of the South Orkneys by Mr. Bruce's expedition in the *Scotia* and subsequently taken over by the Argentine Government. Mr. Mossman's description of his unique experiences is profoundly interesting, and the work of so accomplished a meteorologist in a part of the world whence no previous records have been obtained is invaluable.

MR. JOHN AITKEN, of the Union Bank, Braemar, whose rainfall record has appeared monthly in this Magazine since 1873, and in *British Rainfall* since 1865, dates the commencement of his services to meteorology still further back, and we are happy to see by the following cutting from the *Aberdeen Journal* of April 21st that they have been recognised in an unusual and gratifying manner:—

It was in 1856 that the late Prince Consort founded the Braemar Observatory, which stands at an altitude of 1114 feet above sea level. On its inception Mr. Aitken was appointed observer by its founder, and ever since observations have been taken by him twice daily and reports despatched weekly and monthly to head quarters. To mark the appreciation of the services rendered by Mr. Aitken, the King has sent him a letter, and made him the recipient of a jewelled scarf-pin. The letter which accompanied the gift expresses His Majesty's satisfaction with the attendance paid and the interest taken in the work of the observatory by Mr. Aitken, and expresses the hope that he may be long spared to wear the gift.

Mr. Aitken informs us that he has always had great pleasure in the work, and that he is gratified by the appreciation of his services by those whose desire it is to advance the science of meteorology, a science which he truly observes is deserving of more attention, support and encouragement than it has hitherto received.

BEN NEVIS, although deserted by meteorologists, is occasionally visited, even in the winter months, by mountaineers, who find its cliffs and snow-slopes no mean test of their Alpine craft. In the article on a Ben Nevis glacier, by the Rev. R. P. Dansey, recently published in these pages, the important work of the Rev. A. E. Robertson was dwelt upon, and our readers will regret to hear that a serious accident has befallen that intrepid climber. On April 6th, according to the report of a Fort William correspondent:—

The day was a most unsuitable one for climbing, there being an almost continuous fall of snow, accompanied by thunder and lightning, but, nevertheless, Mr. Robertson set out alone to make the ascent of the mountain. He succeeded in reaching the summit in safety, and started on the return journey. All went well until he was near the edge of a precipice, and, holding on with his ice axe, had commenced to negotiate a dangerous snow slope. Then came a vivid flash of lightning, which Mr. Robertson thinks must have struck the axe, and he was almost immediately precipitated over the slope. Mr. Robertson calculates that he must have rolled nearly 1000 ft. before his progress was stopped, and how long he lay unconscious afterwards he cannot say. He must have dragged himself to his hotel in Fort William in a semi-unconscious condition, for he recollects nothing from the moment when he began to fall.

RAINFALL AND TEMPERATURE, APRIL, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	1·75	+ ·06	·49	9	19	64·7	13	31·6	8	1	11
II.	Tenterden ...	2·33	+ ·56	·92	10	15	63·5	13	29·7	8	2	12
,,	Hartley Wintney ...	1·68	— ·01	·52	30	13	65·0	12	29·0	9, 10	4	8
III.	Hitchin	1·84	+ ·22	·32	10	20	62·0	13	27·0	2	7	...
,,	Winslow (Addington) ...	1·92	+ ·09	·30	9	19	62·0	16	30·0	3, 8	6	10
IV.	Bury St. Edmunds (Westley)	1·82	+ ·28	·39	10	20	61·5	13	28·5	9	4	...
,,	Brundall	2·06	+ ·38	·36	10	24	64·0	14	27·0	8	3	9
V.	Alderbury ...	1·78	— ·10	·36	14	15	62·0	13, 14	29·0	8, 22	7	...
,,	Winterbourne Steepleton ...	2·59	— ·01	·61	13	20	58·3	13	29·5	22	2	12
,,	Torquay (Cary Green) ...	2·65	+ ·20	·67	10	15	59·3	11	36·9	23	0	1
,,	Polapit Tamar [Launceston]	3·21	+ ·98	·63	10	20	56·4	11	30·8	7	3	4
,,	Bath	2·47	+ ·42	·44	10	17	61·0	13	29·2	22	1	14
VI.	Stroud (Upfield)	2·70	+ ·65	·36	11	21	60·0	16	33·0	21	0	...
,,	Church Stretton (Woolstaston)	2·25	+ ·11	·66	30	21	61·0	1	27·5	8	7	...
,,	Bromsgrove (Stoke Reformatory)	1·88	+ ·22	·26	30	17	56·0	13	25·0	21	7	...
VII.	Boston	3·17	+ 1·58	·47	6	18	68·0	29	27·0	8	6	...
,,	Worksop (Hodsock Priory).	1·74	+ ·05	·29	6	21	62·2	13	25·0	3	4	15
,,	Derby (Midland Railway)...	1·37	— ·35	·25	6, 30	21	61·0	13	29·0	7	4	...
VIII.	Bolton (The Park)	4·24	+ 2·09	·73	28	21	57·7	15	28·7	8	3	11
IX.	Wetherby (Ribston Hall) ...	2·55	+ ·57	·41	6	20	...	...	...	...	...	...
,,	Arncliffe Vicarage	6·47	+ 3·15	1·11	30	23	...	...	...	...	...	...
,,	Hull (Pearson Park)	2·44	+ ·72	·41	23	20	60·0	28	27·0	8	3	13
X.	Newcastle (Town Moor) ...	2·88	+ 1·09	·38	14	24	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	12·71	+ 6·44	2·83	1	23	58·2	15	24·5	8	6	—
XI.	Cardiff (Ely)	2·72	+ ·38	·43	10	22	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	4·36	+ 1·69	·80	30	20	58·2	13	32·9	22	0	8
,,	Aberystwith (Gogerddan)...	3·41	+ 1·02	·49	8	18	66·0	13	32·0	17	1	...
,,	Llandudno	1·80	— ·02	·45	6	18	60·8	13	30·5	8	1	...
XII.	Cargen [Dumfries]	3·99	+ 1·69	·76	30	13	58·0	15	25·0	8	8	...
,,	Lilliesleaf (Riddell)	2·84	+ ·88	·35	30	24	55·0	14	21·0	7	12	17
XIII.	Edinburgh (Royal Observy.)	1·48	...	·23	26	17	59·7	14	25·5	8	5	17
XIV.	Colmonell	2·63	+ ·38	·55	1	12	58·0	15, 27	20·0	7	8	...
XV.	Tighnabruaich	3·22	+ ·33	·73	1	16	54·0	30	23·0	7	13	19
,,	Mull (Quinish)	3·14	+ ·34	·70	1	19	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	2·20	+ ·26	·50	14	17	58·3	4	25·6	8	9	...
XVII.	Braemar	2·59	+ ·41	·44	14	22	54·2	4	20·6	8	12	...
,,	Aberdeen (Cranford)	3·43	+ 1·21	·62	30	22	53·0	26, 27	23·0	6	8	...
,,	Cawdor (Budgate)	2·09	+ ·60	·43	22	16	...	...	...	...	...	...
XVIII.	Invergarry	3·12	+ ·44	1·21	1	8	...	...	...	...	...	...
,,	Bendamph	2·95	— 1·39	·48	3	19	...	...	...	...	...	...
XIX.	Dunrobin Castle	1·73	— ·08	·31	5	14	57·0	29	26·0	7, 9	8	...
,,	Castletown	3·39	...	·58	5	26	55·0	26	25·0	6, 7	10	...
XX.	Killarney	4·02	+ ·31	1·07	25	25	62·5	6	32·0	19	...	...
,,	Waterford (Brook Lodge)...	4·01	+ 1·45	·45	8	19	56·5	4a	28·0	8	2	...
,,	Broadford (Hurdlestown) ...	2·48	+ ·31	·49	30	23	58·0	3	28·0	7	3	...
XXI.	Carlow (Browne's Hill)	3·05	+ ·71	·64	30	20	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	2·47	+ ·47	·68	30	25	59·1	14, 27	30·0	8	1	5
XXII.	Ballinasloe	1·33	— ·99	·17	26	24	67·0	13	22·0	8	10	...
,,	Clifden (Kylemore House)..	4·91	+ ·17	·82	26	18	...	...	...	...	...	...
XXIII.	Seaforde	2·46	— ·13	·41	6	19	58·0	29	23·0	7	6	11
,,	Londonderry (Creggan Res.)	3·09	+ ·77	·51	28	21	...	...	...	...	...	...
,,	Omagh (Edenfel)	2·53	+ ·28	·50	6	22	62·0	18	26·0	7	4	14

+ Shows that the fall was above the average; — that it was below it. a—and 7, 27

SUPPLEMENTARY RAINFALL, APRIL, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·56	XI.	New Radnor, Ednol	4·98
,,	Ramsgate, West Cliff	2·63	,,	Rhayader, Nantgwillt	6·67
,,	Hailsham	1·64	,,	Lake Vyrnwy	3·59
,,	Crowborough	2·87	,,	Ruthin, Plâs Dràw	2·58
,,	Osborne	1·83	,,	Criccieth, Talarvor	2·45
,,	Emsworth, Redlands	1·63	,,	Anglesey, Lligwy	2·60
,,	Alton, Ashdell	1·55	,,	Douglas, Woodville	2·87
,,	Newbury, Welford Park	2·49	XII.	Stoneykirk, Ardwell House	2·30
III.	Harrow Weald	1·95	,,	Dalry, Old Garroch	4·57
,,	Oxford, Magdalen College	1·90	,,	Langholm, Drove Road	4·46
,,	Banbury, Bloxham	2·24	,,	Moniaive, Maxwelton House	3·50
,,	Pitsford, Sedgebrook	1·64	XIII.	N. Esk Reservoir [Penicuick]	3·10
,,	Huntingdon, Brampton	1·55	XIV.	Maybole, Knockdon Farm	2·55
,,	Wisbech, Bank House	1·52	,,	Glasgow, Queen's Park	1·92
IV.	Southend	2·48	,,	Campbeltown, Redknowe	2·35
,,	Colchester, Lexden	1·86	XV.	Inveraray, Newtown	3·82
,,	Saffron Waldon, Newport	1·79	,,	Ballachulish House	4·31
,,	Rendlesham Hall	2·24	,,	Islay, Eallabus	3·03
,,	Swaffham	1·91	XVI.	Dollar	2·56
,,	Blakeney	1·44	,,	Loch Leven Sluices	1·93
V.	Bishops Cannings	3·02	,,	Balquhidder, Stronvar	3·83
,,	Ashburton, Druid House	3·89	,,	Coupar Angus Station	1·31
,,	Okehampton, Oaklands	3·54	,,	Blair Atholl	2·17
,,	Hartland Abbey	2·92	,,	Montrose, Sunnyside	3·09
,,	Lynmouth, Rock House	1·92	XVII.	Alford, Lynturk Manse	2·86
,,	Probus, Lamellyn	3·05	,,	Keith	2·43
,,	Wellington, The Avenue	2·43	XVIII.	N. Uist, Lochmaddy	1·77
,,	North Cadbury Rectory	2·10	,,	Aviemore, Alvey Manse	2·19
VI.	Clifton, Pembroke Road	3·16	,,	Loch Ness, Drumnadrochit	1·21
,,	Moreton-in-Marsh, Longboro'	2·67	,,	Glencarron Lodge	...
,,	Ross, The Graig	2·59	,,	Fearn, Lower Pitkerrie	1·82
,,	Shifnal, Hatton Grange	1·87	XIX.	Invershin	2·40
,,	Wem Rectory	1·47	,,	Altnaharra	3·54
,,	Cheadle, The Heath House	2·45	,,	Bettyhill	3·21
,,	Coventry, Kingswood	1·64	,,	Watten	2·54
VII.	Market Overton	1·74	XX.	Cork, Wellesley Terrace	3·27
,,	Market Rasen	1·69	,,	Darrynane Abbey	5·57
,,	Bawtry, Hesley Hall	1·93	,,	Glenam [Clonmel]	5·30
VIII.	Neston, Hinderton	2·16	,,	Ballingarry, Gurteen	1·86
,,	Southport, Hesketh Park	2·60	,,	Miltown Malbay	3·04
,,	Chatburn, Middlewood	3·44	XXI.	Gorey, Courtown House	3·18
,,	Cartmel, Flookburgh	3·89	,,	Moynalty, Westland	2·23
IX.	Langsett Moor, Up. Midhope	3·05	,,	Athlone, Twyford	1·38
,,	Scalby, Silverdale	2·96	,,	Mullingar, Belvedere	2·08
,,	Ingleby Greenhow	3·04	XXII.	Woodlawn	1·71
,,	Middleton, Mickleton	2·78	,,	Westport, Murrisk Abbey	2·47
X.	Beltingham	4·15	,,	Crossmolina, Enniscoe	2·44
,,	Font Reservoir, Fallowlees	1·71	,,	Collooney, Markree Obsy	1·96
,,	Ilderton, Lilburn Cottage	2·62	XXIII.	Enniskillen, Portora	1·93
,,	Keswick, The Bank	4·81	,,	Warrenpoint	2·21
XI.	Llanfrechfa Grange	3·69	,,	Banbridge, Milltown	2·30
,,	Treherbert, Tyn-y-waun	7·88	,,	Belfast, Springfield	2·93
,,	Carmarthen, Friary	5·50	,,	Bushmills, Dundarave	2·15
,,	Castle Malgwyn	5·10	,,	Stewartstown	2·01
,,	Plynlimon	8·20	,,	Killybegs	2·03
,,	Tallyllyn	4·10	,,	Horn Head	2·06

METEOROLOGICAL NOTES ON APRIL, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Typical April weather with frequent changes and no period of settled conditions. There was a spell of cold N. and E. winds from 16th, lasting more or less till 25th, with low temp. and only slight R. A little S fell on 7th and a quantity of sleety H on 18th and 19th. T and L on 16th. Duration of sunshine 91·3* hours and of R 53·7. Mean temp. 47°·6.

TENTERDEN.—Cold, with polar winds on 15 days, but strong S.W. winds at the close. Dry at Easter, but with deficient sunshine, the total for the month being only 117† hours.

CROWBOROUGH.—A typical April, showery and cool, with R ·66 in. above the average of 34 years, reducing the deficiency for the year to ·86 in. From the 17th there was a week of cold wintry weather, with strong N.E. winds and occasional light S, sleet and H. Mean temp. 45°·9, or 1°·7 below the average.

HARTLEY WINTNEY.—Not a good word can be said on the phenomena of the month's weather. Very mild in the first week, then cool, harsh, acrid and sunless days, with rough, biting N. and N.E. winds until the last two days, which were mild and stormy. Ozone daily, with a mean of 3·8.

BRUNDALL.—S fell heavily on 5th and 6th, lying five inches deep on the level. S, sleet and H also fell on 18th and 19th. T and L on 23rd and 30th.

TORQUAY.—Mean temp. 48°·7, or 0°·5 above the average. Duration of sunshine 107·8* hours, being 72·4 hours below the average. Mean amount of ozone 6·0; max. amount 9·0 on 13th, 14th and 30th; min. 3·5 on 12th.

LYNMOUTH.—From 1st to 13th was mild, with sunshine and showers. Cold from 14th to 24th, afterwards mild and warm, with sunshine and R.

NORTH CADBURY.—A very disagreeable April. R was frequent, but the total was only 88 per cent. of the average of 9 years. The max. temp. was much below, and the min. temp. well above, the normal.

CLIFTON.—A rainy month, with R nearly an inch above the normal. The driest period was from 17th to 22nd, under the influence of cold N.E. winds. There were about 45 hours of continuous R from 9th to 11th, and R fell nearly the whole of 25th and 26th. S.S.E. gale and heavy R on 30th.

ROSS.—One of the most cheerless Aprils remembered. The amount of cloud was 8 or more on no less than 25 mornings. R very persistent but not heavy, being about one-third more than the average. Mean max. temp. very low and mean min. much above the average.

WORKSOP.—Cloudy and showery, with mild nights but no warm days. Two inches of S lying at 8 a.m. on 7th. Earthquake shock at 1.36 a.m. on 23rd.

BOLTON.—Temp. generally slightly below the average; mean 42°·7. Duration of sunshine 76·7* hours, 34 hours below the average. Prevailing winds E. and N. till the end, then S. All growing factors were in excess of 1904.

SOUTHPORT.—Exceptionally sunless and rather wet. Mean temp. 1°·3 below the average. Duration of sunshine 46 hours below the average. R ·86 in. above the average. Underground water level still exceptionally low.

LILBURN.—Very cold, with frequent showers of S, H and R and little sunshine. Milder at the end. R above the average.

HAVERFORDWEST.—Fine generally but cold, with no R from 16th to 23rd, after which it was very wet. Vegetation and agricultural operations were generally backward. Duration of sunshine 84·9* hours.

RUTHIN.—The early part was mild and rainy, followed by dull days with cold N.E. and N.W. winds. The last week was mild and rainy.

LLANDUDNO.—A variable month. Very cold from 16th to 20th. H on 5th and S on 7th. Duration of sunshine 106·6* hours. Vegetation very advanced, and lilac and laburnum in bloom at the end. Summer migrants all late.

* Campbell-Stokes. † Jordan

DOUGLAS.—A deplorable month. Except perhaps 1880 and 1891, almost unprecedentedly cold and wintry, with bitter, strong N.E. winds, S, H and frosts. The 21st and 29th were mild.

SCOTLAND.

LILLIESLEAF.—Unusually windy and wet. Very bad seed time, with continual heavy showers and only two consecutive fine days.

COLMONELL.—Mean temp. 43°·9, or 1°·3 below the average of 29 years. About two inches of S on the ground on 7th, the heaviest in April in 29 years.

INVERARAY.—There was a spell of fine dry weather in the middle, but it was too cold for anything to grow, and the season was very backward.

COUPAR ANGUS.—The month opened with a few bright and warm days, but a protracted period of cold and barren weather lasted till 26th, then milder.

DRUMNADROCHIT.—R ·68 in. less than the average of 19 years, but rainy days 8 above the average. Unusually cold, with drizzling R or S almost daily.

CASTLETOWN.—Cold, wet and sunless. S storm from 5th to 10th. The ground was so soaked with water that in many cases turnip crops could not be carted, and at the end only about half the seed was sown and ploughing unfinished.

IRELAND.

DARRYNANE ABBEY.—Again very wet, with R 156 per cent. of the average of 25 years, and only exceeded three times in that period. Cold easterly wind from 8th to 22nd; the rest fairly mild with some hot days.

MILTOWN MALBAY.—Ungenial, cold and dripping, ending a bad spring.

DUBLIN.—Cold, dull and very showery. Mean temp. 46°·8, or 0°·8 below the average. Duration of sunshine 107·8 hours, or 51·2 hours below the average. A very cold Easter.

BELFAST.—Cold and dull until the last week, when a vast change came and spring really commenced. R just over the average.

OMAGH.—With a considerable preponderance of polar and easterly winds and rather above the average R, the weather was mostly ungenial and unfavourable for vegetation.

FOUR MONTHS' RAINFALL OF 1905.

Aggregate Rainfall for January—April, 1905.

Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	6·88	101	Bolton	13·14	119	Braemar	11·45	112
Tenterden	7·86	100	Wetherby	7·21	98	Aberdeen	9·76	104
Hartley Wintney	6·98	88	Arncliffe	20·05	103	Cawdor	10·91	143
Hitchin	6·78	104	Hull	6·27	87	Invergarry	24·78	130
Winslow	6·29	87	Newcastle	5·58	75	Bendamph	33·13	126
Westley	6·64	103	Seathwaite	42·82	99	Dunrobin	13·25	143
Brundall	6·24	96	Cardiff, Ely	11·52	95	Killarney	19·58	99
Alderbury	8·41	98	Haverfordwest	14·95	103	Waterford	13·46	108
Winterbourne	11·07	92	Gogerddan	15·43	126	Broadford	11·91	125
Torquay	10·24	93	Llandudno	9·00	108	Carlow	10·41	100
Polapit Tamar	13·08	115	Cargen	13·86	103	Dublin	7·85	98
Bath	7·58	88	Lilliesleaf	8·10	86	Mullingar	11·41	110
Stroud, Upfield	8·54	100	Colmonell	13·72	101	Ballinasloe	9·48	88
Woolstaston	9·49	103	Glasgow	9·39	95	Clifden	24·65	101
Bromsgrove	6·53	100	Inveraray	25·79	130	Crossmolina	17·29	109
Boston	6·12	100	Islay, Eallabus	17·25	121	Seaforde	10·08	86
Hodsock Priory	4·97	76	Mull	20·39	117	Londonderry	13·15	113
Derby	5·35	78	Dundee	6·50	81	Omagh	13·93	123

Climatological Table for the British Empire, November, 1904.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	58·8	9	24·1	26	47·8	36·7	30·5	91	87·6	16·5	1·70	11	7·2
Malta	71·6	6	46·7	18	64·5	53·6	49·9	75	121·6	44·0	2·82	20	4·4
Lagos	90·0	29	70·5	13	87·5	74·9	75·2	77	143·0	69·5	·63	2	5·8
Cape Town	83·8	25	44·6	13	69·9	54·3	52·7	71	...	...	1·21	6	4·7
Durban, Natal	90·7	26	57·8	5	80·4	65·0	...	...	148·6	...	3·61	18	6·1
Johannesburg	88·3	8	47·2	4	75·5	55·4	51·0	62	...	44·5	4·32	9	2·2
Mauritius	87·0	28	61·9	17	83·5	67·0	62·7	66	155·2	53·0	1·38	10	3·8
Calcutta	88·2	13	55·4	29	82·3	64·7	63·2	72	144·4	50·0	·15	1	2·2
Bombay	92·1	16	69·8	24	87·4	72·7	67·4	68	139·4	58·9	·00	0	1·4
Madras	93·4	5	64·1	24*a*	89·4	69·3	65·6	66	146·8	60·7	·20	3	3·2
Kodaikanal	69·0	27	40·5	28	62·5	45·9	49·9	74	132·2	25·2	·09	1	4·9
Colombo, Ceylon	90·7	29	71·8	23	87·7	74·5	71·4	76	150·5	67·8	3·39	9	6·4
Hongkong	83·7	14	52·2	30	74·0	64·6	56·3	62	132·9	...	·22	5	5·5
Melbourne	92·2	16	41·6	20	71·0	50·8	47·7	65	146·7	33·0	1·29	8	5·4
Adelaide	99·5	16	44·9	7	76·9	53·5	47·7	50	154·5	40·2	·65	7	3·3
Coolgardie	100·6	19	39·0	2	87·9	56·3	46·1	40	168·9	35·2	·70	2	2·4
Sydney	93·2	2	54·2	5	78·4	61·8	56·4	58	132·7	42·8	·46	10	4·2
Wellington	73·8	28	42·6	22	63·8	48·9	45·3	67	140·0	36·0	1·06	7	5·2
Auckland	71·0	25	47·0	17	62·5	52·5	49·8	76	135·0	41·0	4·35	16	5·5
Jamaica, Negril Point	89·6	10	66·8	26	86·4	72·1	72·5	78	...	...	·35	2	...
Grenada	86·4	17	72·0	28	84·1	74·4	72·0	77	152·0	...	5·69	24	3·5
Toronto	58·0	3	9·9	28	43·2	28·6	29·6	78	82·0	3·5	·11	9	5·9
Fredericton	49·8	4	-0·5	29	37·6	20·3	19·0	64	...	...	2·41	8	6·2
Winnipeg	64·8	2	-7·0	30	41·3	22·6	...	...	...	...	·32	2	5·0
Victoria, B.C.	60·0	9	34·0	18	52·7	45·4	45·5	86	...	...	5·23	22	8·1
Dawson	22·0	2	-27·5	18	5·0	-4·3	...	...	...	...	·80	5	5·6

a—and 29.

MALTA.—Mean temp. of air 58°·3, or 3°·8 below average, mean hourly velocity of wind 10·5 miles, or 1·1 above average. Mean temp. of sea 66°·0. T8S on 3 days.

Mauritius.—Mean temp. of air 0°·4, dew point 1°·6, and R ·38 in., below averages. Mean hourly velocity of wind 10·0 miles, or 0·7 mile below average. Computed direction of wind E. by S.

MADRAS.—R the lowest recorded since 1813. Bright sunshine 238 hours.

KODAIKANAL.—Bright sunshine 214 hours.

COLOMBO.—Mean temp. of air 81°·1, or 1°·3 above, of dew point 0°·9 below, and R 9·25 in. below, averages. Mean hourly velocity of wind 7·5 miles; prevailing direction N. and N.W. T8S on 5 days.

HONGKONG.—Mean temp. of air 68°·8. Bright sunshine 187·3 hours. Mean hourly velocity of wind 13·1 miles; mean direction E. 27° N.

Adelaide.—Mean temp. of air 2°·0 below, and bright sunshine 35 hours above the averages, and R ·36 in. below average.

Sydney.—Mean temp. of air 3°·2, above, R 2·64 in. below, and humidity 10·7 p.c. below averages.

Wellington.—Mean temp. of air 0°·9 below, and R 2·51 in. below, averages.

Auckland.—Mean temp. of air 3·5 degrees below, and R 2·20 in. above averages.

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THE RAINFALL AND WEATHER OF MAY, 1905.

The month proved very dry in all parts of the country except in the western Highlands, where the deficiency was less marked. The usual tables give the actual amounts which were recorded at about 150 well-distributed stations, but about 200 additional stations have been utilized in compiling the accompanying map. We should like to be able to print all the figures which were made use of, but that is impossible, and we have to content ourselves with thanking all those who send in observations monthly, every one of whom has been helpful in drawing the map.

On the map the parts of the country where the rainfall of May exceeded one inch, are shaded with a light tint, a darker shading shows places where the falls exceeded two inches, and the lines upon that dark shading denote falls exceeding three and four inches respectively. Except in the extreme south-east and south-west, Scotland had everywhere more than an inch, and in most parts more than two inches of rainfall. The rainfall in Scotland, taking it altogether, was probably about 25 per cent. below the average. Ireland had only a small area with more than two inches, and a still smaller with less than one. It was dry, relatively, in all parts, the general deficiency from the average being something like 36 per cent.

The chief interest of the rainfall lay in England. Here the fall was everywhere far below the average, the deficiency being 57 per cent., not half the normal amount having fallen. But for a thunderstorm which arrived just too early to belong to June, the map would have been more remarkable still. As it is we see that more than an inch of rain only occurred in three districts in the west, viz.: Dartmoor, western Wales, and the Lake District, and also along a more or less irregular belt bordering the east coast, from Beachy Head to the Tees. Round Snowdon and round Seathwaite several inches of rain fell, but that took place on very small patches of country. In the relatively wet belt of the east coast, only one station reported as much as 2·00 in. The thin line running through the unshaded portion of the map includes the driest part of the country upon which less than half an inch of rain, or roughly one-quarter of the

RAINFALL OF MAY, 1905.
Shetland I.
Fair I.
Orkney I.
Butt of Lewis
C. Wrath
St Kilda
The Minch
Hebrides
Skye
Barra Hd
Mull
Islay
Mouth of Clyde
Solway Firth
Isle of Man
Ferris Pt
C. Clear
St. George's Channel
IRISH SEA
Bristol Channel
Land's End
Scilly Is.
Start Pt.
Portland
I. of Wight
Beachy Hd
Flamborough Hd
Spurn Hd
Thames
Channel
English
NORTH SEA
ATLANTIC OCEAN
Moray Firth
Buchan Ness
Aberdeen
R. Tees
R. Forth
R. Tweed
Berwick
Liverpool
Holyhead
Pembroke
Tenby
Swansea
Weymouth
Falmouth
Plymouth
Dover
Ramsgate
Yarmouth
Lowestoft
Harwich
Boston
Wash
Humber
R. Severn
R. Wye
R. Mersey
R. Dee
R. Shannon
Valentia
Waterford
Wexford
Dublin
Belfast
Donaghadee
Portpatrick
Stranraer
Ayr
Girvan
Ailsa Craig
Arran
Campbeltown
Oban
Tiree
Barra
Lewis
Stornoway
Cape Wrath
Duncansby Hd
Kinnaird Hd
Fraserburgh
Peterhead
Montrose
Arbroath
Dundee
Tay
Forth
Edinburgh
Leith
Berwick
Holy I.
Farne Is.
Coquet I.
Tynemouth
Sunderland
Hartlepool
Whitby
Scarborough
Flamborough
Bridlington
Hull
Grimsby
Cromer
Yarmouth
Lowestoft
Harwich
Clacton
Margate
Ramsgate
Dover
Folkestone
Hastings
Beachy Hd
Eastbourne
Brighton
Worthing
Littlehampton
Bognor
Selsey Bill
Portsmouth
Southampton
Bournemouth
Poole
Weymouth
Portland
Lyme Regis
Exmouth
Teignmouth
Torquay
Dartmouth
Plymouth
Falmouth
Penzance
Scilly Is.
Land's End
Start Pt.
Salcombe
Brixham
Torbay
Exeter
Sidmouth
Seaton
Lyme Regis
Portland
Weymouth
Swanage
Bournemouth
Poole
Christchurch
Southampton
Portsmouth
Selsey Bill
Bognor
Littlehampton
Worthing
Brighton
Eastbourne
Beachy Hd
Hastings
Folkestone
Dover
Ramsgate
Margate
Clacton
Harwich
Yarmouth
Lowestoft
Cromer
Wash
Boston
Grimsby
Hull
Bridlington
Scarborough
Whitby
Hartlepool
Sunderland
Tynemouth
Coquet I.
Farne Is.
Holy I.
Berwick
Edinburgh
Leith
Forth
Tay
Dundee
Arbroath
Montrose
Peterhead
Fraserburgh
Kinnaird Hd
Duncansby Hd
Cape Wrath
Stornoway
Lewis
Barra
Tiree
Oban
Campbeltown
Arran
Ailsa Craig
Girvan
Ayr
Stranraer
Portpatrick
Donaghadee
Belfast
Dublin
Wexford
Waterford
Valentia
Shannon
Severn
Wye
Mersey
Dee
Tees
Thames
Humber
Spurn Hd
Flamborough Hd
Yarmouth
Lowestoft
Harwich
Clacton
Margate
Ramsgate
Dover
Folkestone
Hastings
Beachy Hd
Eastbourne
Brighton
Worthing
Littlehampton
Bognor
Selsey Bill
Portsmouth
Southampton
Bournemouth
Poole
Weymouth
Portland
Lyme Regis
Exmouth
Teignmouth
Torquay
Dartmouth
Plymouth
Falmouth
Penzance
Scilly Is.
Land's End
Start Pt.
Salcombe
Brixham
Torbay
Exeter
Sidmouth
Seaton

usual amount fell. It includes the north of Cornwall, North Devon, the whole of Somerset, most of Dorset, Wiltshire, Hampshire, Gloucester, Monmouth, Glamorgan and Breconshire, the whole of Worcestershire, most of Warwickshire and Leicestershire, and considerable parts of Staffordshire, Derbyshire, Nottinghamshire and the south of Yorkshire. The dearth of rain culminated in the districts bordering on the Bristol Channel, where less than a quarter of an inch of rain fell during the month, and in some cases less than one-tenth of an inch. Several observers report that no May, and some that no month, had proved so dry in a long period over which observations extended. We quote a number of the most remarkable figures which we have received.

Stations reporting ·15 *in. or less of Rain in May*, 1905.

		Total Rain. in.	No. of Days.	Max. Fall. in.	Date.
Devon	Braunton, Light House	·03	2	·02	11
,, ...	,, Saunton	·06	2	·05	11
Somerset ...	Bath, Henrietta Park.....	·07	6	·02	18
Devon	Westward Ho !, Ferndale	·10	3	·03	1, 2, 31
,, ...	Instow	·10	2	·06	2
Somerset ...	East Harptree, Harptree Court...	·11	5	·04	1
Gloucester .	Clifton, Pembroke Road	·11	7	·03	31
Glamorgan	Penarth	·11	3	·06	1
Devon	Hartland Abbey	·12	4	·04	11
,, ...	Woolacombe	·13	4	·04	11
Glamorgan	Cardiff, Ely	·13	3	·08	1
Devon	South Molton, Castle Hill School	·15	4	·06	1
,, ...	Bideford, Horwood	·15	4	·07	2
,, ...	Northam	·15	4	·06	2
,, ...	Ilfracombe Hotel.....	·15	3	·03	1
,, ...	Martinhoe	·15	4	·06	2
,, ...	Lynmouth, Rock House.....	·15	4	·07	1

Taken as a whole England has been drier in the month of May than it was this year, and we need go no farther back than 1896 for a striking example. In that month only one station, quoted in this Magazine, from England or Wales recorded so much as one inch (and that was Seathwaite), while at most stations almost the whole of the trifling fall occurred on one day. May, 1905, can bear no comparison with so exceptional a month, but it has points of individual interest notwithstanding. In the Observers' Notes it will be seen that north-easterly and easterly winds prevailed in England to an extent unusual even in that month of east winds, and the low rainfall of the south-west of England with the steady increase of rain from Cornwall to Norfolk, may be looked upon as a direct result of the inversion of the prevailing wind, while farther north the Welsh mountains, on account of their height and the increased cooling and condensation, appear to have masked this result to some extent.

The Table of Aggregate Rainfall shows that the result of the dry month has been to throw practically the whole of England, the south-

east of Scotland, and the east of Ireland, considerably below the average for the five months to the end of May. Parts of the south-east of England, however, have come very near the average, and a remarkable deficiency is confined to the north Midlands.

The month was very free from cloud, remarkable for the large number of hours of sunshine, for high maximum temperatures, and, as is natural enough, for low minimum temperatures also. Severe night frosts did a great deal of damage in many parts of the country, and though we may hope that the first reports in the newspapers were exaggerated, there can be no doubt that the fruit crop was seriously affected.

Several letters from correspondents, on another page, deal with the nature of the month of May in different parts of the country, and we may conclude this article with a condensed quotation from the *Evesham Journal* of May 27th.

"We are sorry to have to record that the market gardeners of the town and district have sustained a most serious reverse owing to the frosts of Monday and Tuesday mornings. At the end of last week the gardens were looking exceedingly well, and there was every prospect of a successful season, and the outlook pointed to a heavy crop of plums. Now, however, the condition of things has totally changed. Monday morning's frost did a certain amount of damage, but that of the following morning was disastrous.

"The thermometer in the screen at Lansdowne registered only two degrees each night; this would be equal to about five degrees on the grass. At Beckford nearly five degrees of frost were registered in the screen, and eight degrees on the grass. In other parts the frost seems to have been more severe, particularly at Toddington. Speaking broadly, the frost has played havoc on the low lying grounds, leaving the higher land either unhurt or only slightly damaged.

"Perhaps the frost was most severely felt in the low strip of ground which runs from Hampton across the Cheltenham Road to the Mint, and along by the Red Barn between Bench Hill and Longdon Hill. Here it made a clean sweep of everything, as it has done on previous occasions. Plums, strawberries, beans and so on were destroyed in very large quantities, and strawberry beds which were a picture on Sunday presented a very dismal sight on Tuesday.

"These terrible visitations of frost lead one to wonder whether some steps cannot be taken to counteract or forestall them. It sounds somewhat far-fetched, but we do not think it at all beyond the bounds of possibility to find means for fighting the frost. It is not so very many years ago since some people objected to the investigations of the Evesham Fruit Pests Committee—on the ground of impiety for one thing! 'You can syringe 'em,' it was said, 'and you can grease-band 'em; but it's no use; you can't fight against the Almighty.' Perhaps even now some people would object to fighting the frost on the same grounds."

FIVE MONTHS' RAINFALL OF 1905.

Aggregate Rainfall for January—May, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	8·06	94	Bolton	13·95	103	Braemar	13·10	105
Tenterden	9·10	95	Wetherby.....	7·82	85	Aberdeen	10·98	95
Hartley Wintney	7·73	80	Arncliffe	21·03	92	Cawdor	12·99	134
Hitchin	8·78	105	Hull	6·78	74	Invergarry ...	27·51	126
Winslow.....	7·05	76	Newcastle.....	6·09	65	Bendamph ...	37·13	119
Westley.....	7·90	95	Seathwaite ...	51·00	101	Dunrobin	14·39	127
Brundall	7·65	93	Cardiff, Ely ...	11·65	79	Killarney ...	21·05	93
Alderbury	...	...	Haverfordwest	16·26	95	Waterford ...	15·05	103
Winterbourne ...	11·60	83	Gogerddan ...	17·05	116	Broadford.. ...	13·23	114
Torquay.....	10·80	84	Llandudno ...	9·43	93	Carlow	12·06	95
Polapit Tamar ...	13·56	102	Cargen	16·03	100	Dublin	9·03	91
Bath	7·65	71	Lilliesleaf.....	8·97	78	Mullingar.....	12·60	99
Stroud, Upfield...	9·28	88	Colmonell	14·61	91	Ballinasloe ...	10·67	81
Woolstaston	10·16	86	Glasgow	10·94	89	Clifden	...	...
Bromsgrove	6·93	81	Inveraray	29·49	129	Crossmolina ...	18·85	100
Boston	7·47	96	Islay, Eallabus	20·27	122	Seaforde	11·06	78
Hodsock Priory..	5·39	63	Mull	23·79	117	Londonderry..	15·14	107
Derby.....	5·74	65	Dundee	7·90	79	Omagh	15·12	117

Correspondence.

To the Editor of Symons's Meteorological Magazine.

PARTIAL DROUGHT IN MAY.

I SEND herewith a few notes of the recent dry weather.

A partial drought of 37 days with 0·35 in. of rain lasted from May 3rd to June 7th inclusive, the rain falling on 9 days, the heaviest being ·11 in. on May 14th. The only other dry period comparable with this in my register (commencing December, 1880) was in 1889, when the 35 days from June 3rd to July 8th (inclusive) had only ·19 in., of which 25 consecutive days were rainless—*i.e.*, June 11th to July 5th.

I have also a record of 25 days entirely without rain in 1887, from June 9th to July 3rd, and by going 5 days further back, 30 days with only ·01 in. of rain.

In 1899 also there were 24 consecutive days without rain; May 25th to June 17th.

In this climate both absolute and partial droughts according to your definitions are rare. I have altogether 10 absolute and 4 partial in 24½ years, their duration being—

Absolute Droughts.	*Partial Droughts*
3 of 15 days	1 of 29 days
3 ,, 16 ,,	1 ,, 33 ,,
1 ,, 17 ,,	1 ,, 35 ,,
1 ,, 24 ,,	1 ,, 37 ,, (to date)
2 ,, 25 ,,	

CHARLES L. BROOK.

Harewood Lodge, Meltham, June 9th, 1905.

RANGE OF TEMPERATURE DURING MAY, & HEAVY RAINFALL DURING THUNDERSTORM ON MAY 30th, 1905.

THE extreme range of temperature experienced here during the month of May may seem worthy of notice in your pages. On May 23rd the thermometer in the screen fell to 28°, considerable damage being caused by the sharp frost, especially to laurels and potatoes. On the 29th the shade maximum rose to 84°·2, thus giving the extreme range of 56°·2 for the month. I may add that the thermometers are Kew certified instruments.

On May 30th a sharp thunderstorm broke at 3.27 p.m., being accompanied by a perfect deluge of rain, lasting for a period of 23 minutes (to 3.50 p.m.); during this space of time the amount registered was ·66 in, or a fall at the rate of nearly ·03 per minute. The amount recorded previously for the month only totalled ·61 in., 24 days having been absolutely rainless.

SPENCER C. RUSSELL, F. R. MET. SOC.

Ashley Road, Epsom, June 1st, 1905.

[The fall of ·66 in. in 23 minutes, though interesting, is not unusual, as great an amount has frequently been recorded in half the time.—ED. *S.M.M.*]

MAY FROSTS.

YOUR readers may be interested to know that two sharp frosts—for the time of year—were registered in this district during the early mornings of May 23rd and 24th :—

23rd ..... Grass min. 28°·2 ; screen min. 30°·9.
24th ..... ,, ,, 29°·8 ; ,, ,, 31°·7.

The instruments were verified at Kew.

W. J. CARTER.

Edenfield, New Malden, Surrey, 25th May, 1905.

THE shade temperatures registered yesterday morning were maximum 53° and minimum 32°, while this morning they were maximum 53° and minimum 31°. In May, 1898, 1900, 1901, 1903 and 1904,

there was no frost, the minimum temperature being 33°. In May, 1894, 31° was registered on 21st; in 1896, 32° on 3rd; in 1897, 30° on 13th; in 1899, 31° on 5th; and in 1902, 29° on 14th. This year furnishes a record for the end of the month at this station.

WILLIAM HALL.

Swerford, Oxfordshire, May 23rd, 1905.

PARTIAL DROUGHT, MAY, 1905.

FROM 3 p.m. on 3rd May, 1905, to 4 a.m. on 1st June, 1905, or 28 days 13 hours, the only measurable rain that fell was ·05 in. on four days, three with ·01 in., and one with ·02 in., showing an average rainfall of only about one-fifth of the maximum named in the definition of a partial drought. Within this period was included an all but absolute drought, viz.: from 4 p.m. on May 11th to 4 a.m. on the 24th—12½ days—with no rainfall.

Either *partial* or *absolute* droughts are so rare in mid-East Cheshire—where Wilmslow lies—that I thought it worth while to report the above at once.

EDWARD PEARSON.

Parksyde, Wilmslow, 2nd June, 1905.

FROST IN URUGUAY.

NOT long ago I received a copy of the *International Geography*, and in reading over the article on the Republic of Uruguay my attention was drawn to a part where the writer clearly states that frosts never occur.

I consider it is a pity that such an error should occur in what, otherwise, is a most excellent description of the country in which I have been a resident for the last fifteen years. A neighbour of mine, who has taken meteorological observations for many years back, tells me that as many as 13° F. have been registered, and there is never a winter without a succession of heavy frosts falling.

HERBERT J. WALKER, M.B. EDIN.

Estacion Molles, Uruguay, February 25th, 1905.

[It is not clear whether the statement as to 13° means a temperature of 13° F., or 13° of frost (19° F.); but the fact is plain that severe frosts do occur.—ED. *S.M.M.*]

GLACIAL SNOW ON BEN NEVIS.

THE Rev. R. P. Dansey referred in his interesting article in the March number on the Glacial Snow on Ben Nevis, to the difficulty of recording the rainfall in the corrie—called Allt-a-Mhuilinn—situated on the N.E. side of Ben Nevis, during the winter months.

Considering the height, geographical position of Ben Nevis, and the favourable features of this corrie to produce high rainfall, I am inclined to believe with Mr. Dansey that the wettest spot in Great Britain will be found in this corrie.

As the amount of the rainfall has been so thoroughly investigated at both the summit and the foot of Ben Nevis for so many years, and as the rainfall of probably the wettest spot in such an interesting district is still unknown, I beg to ask—could not some local people, or others, undertake to ascertain the rainfall in the corrie for only *a few months* of the coming summer.

If gauges were fixed in the corrie and on the summit, and measured, say once or twice during June, July, August and September, and *all* measured at the *same date* as those of Fort William, this would give a good idea of the amount at the supposed wettest spot for a long period, and its relation to that at the summit and at Fort William. Also by selecting these months it would enable us to record the actual precipitation, and afford a more true comparison because of the large proportion of the precipitation falling as snow during the other months, which by being blown and mixed with drift from all directions above the gauges, makes it very difficult to measure the real amount of moisture at the summit of the corrie.

I find from the one-inch Ordnance map that the corrie runs almost in a straight line towards N.W., and that the Ordnance contour lines intersect the Allt-a-Mhuilinn stream at fairly uniform distances, and in order that the records should be taken in a systematic manner, and at spots where others could see and study the different results from the map, I beg to suggest that gauges should be fixed at the points where the following contour lines crosses the stream, say 1000, 1500, 2000, 2500, and 3000 feet, and also at the summit; the distances of such spots from the main road, near the Ben Nevis Distillery, are only $1\frac{1}{2}$, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, and 4 miles, respectively, all along the same path to the end of the corrie. For a temporary purpose like this, I should think that galvanized iron, simply made into a cylindrical form, say 24 inches deep, and 5 inches diameter (for measuring a possible two weeks maximum rainfall), with a cap on the top, and the lower part of the cone turned upwards, to prevent evaporation, also a small cylinder of, say 4 inches diameter, and 4 inches deep,—which would of course hold and lift a known quantity of rain—would be suitable to do the work, and could be made by any local tinman at a small cost.

It will be seen that in order to have a good idea of the rainfall at this interesting corrie for a long period, it is *absolutely* necessary to record that of the summit and at Fort William for the *same period*, and the gauges should be fixed 10 to 20 yards from the stream, if possible on a flat piece of ground, or a slight slope, the top being 12 inches above ground, and clear of rocks, boulders and precipices.

J. R. GETHIN JONES.

Bodgethin, Deganwy, May 9th, 1905.

[We trust that Mr. Gethin Jones's suggestions will lead to some action being taken; but the Ben Nevis Observatories have been closed, and we are not aware of a single rainfall record left in Fort William. This is the more deplorable because, unless we are mistaken, 1905 is the first year since 1875 without rainfall observations at that extremely interesting locality. Here is a definite and simple problem, one of the few in which an active observer, even without special scientific training, may furnish the data for an important piece of scientific work.—ED. *S.M.M.*].

THE PARALLEL BETWEEN 1896 and 1905.

IF I may write a third time on this subject I would begin by saying that the weather of 1905 seems to have great difficulty in getting out of the groove of 1896.

It is true that last April made an attempt to do so. Cloudy, cold and showery, it bore little resemblance to the dry and sunny April of 1896. But in one important respect the two months were not very dissimilar. The Observers' Notes in the Magazine for 1896 show that dry though that April was, there was a marked absence of easterly winds; and it does not appear that this year the winds from between N. and E. were at all more than one expects in April. Where you have printed precise figures they seem to have ranged from 10 to 15 days.

But whatever success April may have had in departing from the 1896 pattern, May certainly fell back into the old groove. The Observers' Notes in the 1896 Magazine might be describing the May just ended. The extremely low rainfall, the decided preponderance of N. and N.E. winds, the bright sunny days with keen dry air, the cold clear nights, the injurious frosts during the first week and again just after the 20th, are features which, limited though my information is, I suspect are by no means confined to Somersetshire.

Let us hope that if England is to have repeated the hot dry July of 1896, it may also have during the next few days the welcome refreshing rains of the first ten days of that June. They are sorely needed.—Yours faithfully,

H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, Somerset, June 2nd, 1905.

[So far as the refreshing rains of early June are concerned, Mr. Boys has proved himself once more to be a true prophet; but it is extremely difficult to carry out such a comparison as he attempts in any but the most general terms. The heavy rains of the last days of May in the neighbourhood of London changed the character of the month at the last moment, and left the west of England, which escaped the thunderstorm, very much drier than the east, while in the north the early part of June has proved to be extremely dry, in marked contrast to the south.—ED. *S.M.M.*].

THE ANTARCTIC METEOROLOGICAL STATION IN THE SOUTH ORKNEYS.

By R. C. Mossman, F.R.S.E.

The work at this station commenced at the end of March, 1903, on the arrival of the "Scotia" in winter quarters, and terminated, so far as my connection with the station was concerned, on January 1st of the present year. In this short notice it is not intended to go with any detail into the climatic problems of the region in question; but merely to give some of the more salient features associated with our meteorological work there. From March 25th till the end of October, 1903, the observations were taken on the "Scotia," which was frozen in, in the centre of a large bay on the south side of Laurie Island. For wind observations the position occupied was remarkably good, although westerly winds were deflected somewhat owing to high land a short distance off in that direction. During the winter of 1903 the staff, officers and crew were occupied in building a house on a narrow spit that here divides the north from the south side of the island, and close to this an auxiliary meteorological station was established soon after the "Scotia" went into winter quarters. For wind directions this place was not so good as at the position where the ship wintered, as the cliffs to the west were nearer and the disturbing effect consequently greater. In this connection special attention was given to the movement of the lower clouds. On November 1st the hourly observations were transferred from the ship to the shore, where a land party had been installed to carry on the work while the "Scotia" was absent at Buenos Aires.

The instruments employed at this station were those that experience had shown to give satisfactory results under the prevailing climatic conditions. The instruments in use during 1904, when the station was under Argentine auspices, were much the same as formerly. The barometer, of the Fortin pattern, was hung in the living room of the house as far from the stove as possible. There were also two large Richard barographs, one recording in millimeters and the other in inches. The thermometer screens, five in number, were fixed on to two thick spars resting on cairns and securely anchored to the ground by stout cables. This precaution was necessary owing to the extreme violence of the squalls that occurred from time to time. In these screens were two thermographs, two hygrographs, two pairs of dry and wet bulb thermometers, and a maximum and minimum registering thermometer. Screwed to the outside of one of the screens was a stand containing a black bulb solar radiation maximum in vacuo. Close to the screens was a snow gauge, while a little further off was the Robinson anemometer, mounted on a post with the cups about seven and a half feet above the ground. There were also two sunshine recorders, one a Jordan and the other a Campbell-Stokes instrument. A terrestrial minimum thermometer was occasionally in use. Hourly observations were

METEOROLOGICAL STATION, SCOTIA BAY, LAURIE ISLAND.—WINTER AND SUMMER VIEWS.

taken, and, as there were four observers, the day was divided into four watches of six hours each and the watches changed every week. By this arrangement each observer had ample opportunity to get plenty of exercise, or to engage in natural history or magnetic work. In addition to the station observations, simultaneous readings were made during the first winter by all the sledge parties.

With regard to the general working of the instruments, in the main satisfactory results were obtained. As is usual on polar expeditions, there was a good deal of trouble with the wet bulb, which required much attention. At temperatures below 10° F. I found the best method was to do away with the muslin covering altogether, and merely use a film of ice by painting water on with a camel hair brush. The hair hygrographs at low temperatures gave better all-round results than the wet bulb thermometer, but the traces were frequently imperfect owing to the blizzards that prevailed. So fine was the snow that the inside of the recording instruments was full of it, and even the anemometer got filled once or twice although protected by a glass cover. Most of the snow that fell was hard and granular, and large flakes—so common at home—were rarely seen. Silver thaw, or rain falling with a temperature under the freezing point, was of frequent occurrence and gave much trouble owing to the frequency with which the screens became choked with icy incrustations. The deposition of snow crystals from fog was occasionally observed, but the crystals seldom exceeded five inches in length. On three occasions a curious phenomenon was seen at the mouth of crevasses from which smoke appeared to be issuing. The air temperature when this occurred was from 10° to 30° below zero, and the intense frost had evidently cracked the ice and liberated a quantity of relatively warm air from the interior, the water vapour of which condensed on contact with the cold external atmosphere. A smoke-like haze, known as the "Barber," was often observed issuing from open lanes or pools of water amidst the ice, the result of the great difference (often 50° to 60°) in the temperature of the water and the air in contact with it. Remarkable mirage effects were common, icebergs being observed in the air in an inverted position, at one moment lying flat like a pancake the next shooting up into tall spiral columns, while from time to time portions would appear to break off and sail away only to reunite again in a few moments. Solar and lunar halos, accompanied by mock suns or moons with horizontal and vertical circles, were also occasionally observed, but rainbows were uncommon.

Colourless fog bows, both solar and lunar, were also noted at times. Not a single case of the aurora was seen during the two years of observations, and it is interesting to note that none were reported by Nordenskjöld or Charcot, who both wintered further south and to the west of the South Orkneys, so that auroral displays must be of infrequent occurrence in this region. With regard to the clouds, the most typical form both summer and winter was stratus,

which in the former season covered the sky for days together without a break. The clouds seemed to form at a very low elevation, and even cirri were seen quite close—say, from 6,000 to 8,000 feet above the ground—but as no observations were made no definite heights can be assigned for the various cloud levels. Föhn winds were noted on several days, usually in winter, the highest temperatures recorded being 46°·8 on May 31st, 1903, and 47°·0 on February 11th, 1904. A peculiarity of these winds was the instability of temperature during their occurrence, which was clearly shown by the curve of a quickly moving thermograph. When these abnormally warm winds occurred they invariably blew from the W.N.W., in which direction are located some high mountains. The curious rise of temperature during blizzards, reported at the winter quarters of the "Discovery" and by Nordenskjöld, was not observed. The lowest temperature of the period occurred on August 3rd and 4th, 1904. On both these days a minimum of —40° F. was recorded, with a mean for the latter day of —33° F., and as late as October 11th, 1904, the temperature fell to —25° F, all remarkably low temperatures when one considers the low latitude (60° 47′ S.) of the observatory, and the fact that it is located on an oceanic island. The mean annual temperature is, approximately, 23°·0 F., and the mean barometric pressure 29·260 inches,* but both these values are liable to slight alterations. The highest pressure observed was 30·113 inches on October 3rd, 1903, and the lowest 27·992 inches on June 8th, 1904. There is much cloud, the mean annual amount (overcast sky or fog, 100) being 82. Summer is the cloudiest time, and winter has the least cloud. As regards the discussion of results, the values for 1904 have been worked out and prepared for publication under the direction of Mr. Walter G. Davis, the able chief of the Argentine Meteorological Office, and will appear shortly. Meanwhile good progress is being made with the reduction of the "Scotia's" observations on land and sea, but some little time must necessarily elapse before the data are published.

Mr. Mossman has kindly supplied photographs of the station as it appeared in winter and summer conditions, and these are reproduced in illustration of his description.

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* The barometric readings are corrected to 32° and sea level, but not to standard gravity at 45°.

ROYAL METEOROLOGICAL SOCIETY.

THE first of the Afternoon Meetings for the present session was held on Wednesday, May 17th, in the Society's Rooms, 70, Victoria Street, Westminster, Captain D. Wilson-Barker, Vice-President, in the chair.

Mr. Richard Strachan, F.R.Met.Soc., read a paper on the "Measurement of Evaporation." He pointed out that the rainfall, evaporation and percolation are related to each other; and that rainfall is commonly considered to form the sum of evaporation and percolation. If two of these quantities are found by experiment or observation, the other is assumed to be known. This, however, does not always hold good. A month may be very dry, and still evaporation will go on at the expense of previous percolation—and otherwise. A month may be excessively wet; then there may be a fourth item in the account—viz., overflow. If evaporation, and also percolation, could be observed as readily and closely as is rainfall, then overflow could be detected and measured.

As it is unfortunately not possible to make evaporation and percolation the subject of experiment except at a very few observatories, the author thinks that it is desirable to be able to estimate, even empirically, the probable amounts of each. By using the meteorological data published for the Royal Observatory, Greenwich, he has calculated the probable evaporation for the year 1898, which agrees very closely with the observed evaporation at Camden Square and also at Croydon.

The Chairman thought it was unfortunate that a standard evaporimeter was not obtainable.

Dr. H. R. Mill said that the subject of evaporation was one of great importance and no less difficulty. He had continued Mr. Symons's observations and was not without hope of arriving at some definite conclusion from the readings.

Mr. Baldwin Latham said that all calculations of evaporation were liable to considerable errors. He did not think the taking of the temperature of the ground at Greenwich at one inch in depth at noon at all represented the true mean temperature of the water evaporated at Camden Square or Croydon. It was not possible to arrive at the true amount of evaporation by deducting the depth of water passing through a percolating gauge from the depth of rainfall, for the simple reason that during some months in a year no percolation takes place, the gauges are comparatively dry, and there is no water to evaporate.

A paper by Dr. John Ball, of Cairo, on a "Logarithmic Slide-Rule for Reducing Readings of the Barometer to Sea Level," was read by the Secretary. This slide-rule has been devised for the purpose of saving the time and labour usually occupied in calculation.

The Chairman and Mr. W. Marriott took part in the discussion.

Capt. J. J. Alsop, Mr. W. P. Gibbons, J.P., Mr. S. W. S. Morris, Mr. C. G. Trevett, and Rev. H. W. Williams, M.A., were elected Fellows of the Society.

METEOROLOGICAL NEWS AND NOTES.

THE METEOROLOGICAL OFFICE has now been placed under the charge of Dr. W. N. Shaw, F.R.S., as Director of Meteorology, instead of under the Meteorological Council with Dr. Shaw as Secretary. We have not yet been able to ascertain authoritatively what the new constitution of the Office is, or how far the Report of the Treasury Committee (see this Magazine, vol. **39**, p. 101) has been acted upon, and we can only hope that the Director has a free hand and increased resources.

METEOROLOGY AT THE PUBLIC SCHOOLS is, we are glad to see, receiving increased attention. It is pleasant to quote the following paragraph from the *Standard* of June 8th :—

> Harrow hitherto has been alone among the Public Schools in the non-registration and in the non-publication of an annual series of weather observations. The principal cause of this—the lack of the necessary apparatus—no longer exists, as Mr. F. Druce has now presented the school with a full equipment for the registration of temperature, moisture, and rainfall. The donor has completed his gift by a collection of books on meteorology, which have been placed in the Vaughan Library. The means thus provided of recording and describing the atmospheric variations as to climate and weather will be much appreciated by the Harrovian residents, who have experienced, in 1879, in 1897, and on May 30th last, three local storms of exceptional severity.

THE ARGENTINE GOVERNMENT have purchased the Antarctic research ship, *Le Français*, which recently arrived at Buenos Aires with Dr. Charcot's Expedition on board. Mr. Davis, director of the Oficina Meteorologica Argentina, hopes next summer to be able to establish meteorological and magnetical stations on one of the South Sandwich group, and possibly on Wandel Island, where Dr. Charcot's expedition wintered. Records from the sub-Antarctic station of South Georgia are being maintained during the present year, while the First Order station on Laurie Island, South Orkneys, established by the Scottish Antarctic Expedition, is being continued for a second year under Argentine auspices.

DR. J. HANN'S "LEHRBUCH DER METEOROLOGIE," recently reviewed in these pages, is, we are happy to see, already coming out in a new edition, which, like the first, is appearing in periodical parts. There is no other storehouse of the facts and theories of meteorology so well stocked as this, and it is simply indispensable to all students with whom the language is no bar. The translation of this work would confer an immense boon on the not-inconsiderable number of English-speaking meteorologists who do not read German.

AMAZING VALUES FOR THE RAINFALL appeared in a return recently received, and the figures could not be explained until they were referred to the observer, who solved the problem by explaining that an assistant in copying out the figures had strayed, now and again, into the adjoining column of wet bulb temperature readings!

RAINFALL AND TEMPERATURE, MAY, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Greatest in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	Ye Sy ta m Shade
		inches	inches.	in.							
I.	London (Camden Square) ...	1·18	— ·54	·41	30	9	83·2	29	35·1	23	0
II.	Tenterden ...	1·24	— ·48	·51	1	8	79·2	29	32·5	23	0
,,	Hartley Wintney ...	·75	— 1·04	·48	31	3	76·0	29, 30	33·0	22	0
III.	Hitchin ...	2·00	+ ·13	1·57	30	9	...	...	...	...	...
,,	Winslow (Addington) ...	·76	— 1·30	·43	30	8	79·0	29	28·0	23	3
IV.	Bury St. Edmunds (Westley)	1·26	— ·59	·63	30	7	81·5	29	29·0	23	...
,,	Brundall ...	1·41	— ·33	·69	1	12	80·2	29	33·6	23	0
V.	Alderbury ...	...	...	...	...	...	...	...	...	...	...
,,	Winterbourne Steepleton ...	·53	— 1·49	·26	1	8	69·7	17	29·6	23	1
,,	Torquay (Cary Green) ...	·56	— 1·40	·43	1	5	68·8	17	37·9	4	0
,,	Polapit Tamar [Launceston]	·48	— 1·50	·26	1	5	69·4	20	28·1	23	4
,,	Bath ...	·07	— 2·02	·02	18	6	71·5	28	32·0	23	1
VI.	Stroud (Upfield) ...	·74	— 1·36	·27	3	6	73·0	31	36·0	3	0
,,	Church Stretton (Woolstaston)	·67	— 1·95	·20	1	7	68·5	28	32·0	22	1
,,	Bromsgrove (Stoke Reformatory)	·40	— 1·54	·14	1	6	72·0	28	26·0	22	0
VII.	Boston ...	1·35	— ·38	·62	30	6	83·0	28	30·0	23	1
,,	Worksop (Hodsock Priory).	·42	— 1·59	·32	1	4	75·6	28	27·6	23	3
,,	Derby (Midland Railway)...	·39	— 1·57	·27	1	5	76·0	28	30·0	5	2
VIII.	Bolton (The Park) ...	·81	— 1·65	·34	1	8	71·0	28	33·9	22	0
IX.	Wetherby (Ribston Hall) ...	·61	— 1·29	·29	1	8	...	...	...	...	...
,,	Arncliffe Vicarage ...	·98	— 2·38	·41	1	11	...	...	...	...	...
,,	Hull (Pearson Park) ...	·51	— 1·44	·36	1	9	79·0	28	31·0	23	3
X.	Newcastle (Town Moor) ...	·51	— 1·38	·11	3	14	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	8·18	+ ·92	2·21	28	13	72·2	18	32·6	22	1
XI.	Cardiff (Ely) ...	·13	— 2·42	·08	1	3	...	...	...	...	...
,,	Haverfordwest (High St.)..	1·31	— 1·22	·43	1	7	71·0	18	33·2	23	0
,,	Aberystwyth (Gogerddan)..	1·62	— ·82	·46	10	5	76·0	17	27·0	8	0
,,	Llandudno ...	·43	— 1·42	·16	31	7	68·0	28	39·5	23	0
XII.	Cargen [Dumfries] ...	2·17	— ·43	1·44	28	8	73·0	17, 18	31·0	23	0
,,	Lilliesleaf (Riddell) ...	·87	— 1·20	·23	1	14	69·0	31	30·0	4	0
XIII.	Edinburgh (Royal Observy.)	·55	...	·22	28	9	64·8	28	34·8	22	0
XIV.	Colmonell ...	·89	— 1·61	·20	26	7	75·0	18	28·0	25	0
XV.	Tighnabruaich ...	2·95	— ·26	·66	28	13	65·0	18	32·0	3	0
,,	Mull (Quinish) ...	3·40	+ ·49	·61	24	19	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	1·40	— ·48	·40	26	12	67·7	31	33·0	23	0
XVII.	Braemar ...	1·65	— ·64	·54	25	15	70·0	17	30·0	4	0
,,	Aberdeen (Cranford) ...	1·22	— ·98	·24	26	14	68·0	30	30·0	22	0
,,	Cawdor (Budgate) ...	2·08	+ ·05	·28	28	18	...	...	...	...	...
XVIII.	Invergarry ...	2·73	— ·11	·60	10	10	...	...	...	...	...
,,	Bendamph ...	4·00	— 1·05	·90	5	18	...	...	...	...	...
XIX.	Dunrobin Castle ...	1·14	— ·88	·20	23	15	63·5	29	35·0	24	0
,,	Castletown ...	...	...	...	...	...	...	...	...	...	...
XX.	Killarney ...	1·47	— 1·48	·35	26	13	75·0	16	34·0	4	0
,,	Waterford (Brook Lodge)...	1·59	— ·52	·36	28	10	69·5	18	39·0	23	0
,,	Broadford (Hurdlestown) ...	1·32	— ·77	·21	25	14	70·0	18	34·0	3	0
XXI.	Carlow (Browne's Hill) ...	1·65	— ·70	·79	1	10	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·18	— ·76	·71	1	10	70·9	28	36·9	4	0
XXII.	Ballinasloe ...	1·19	— 1·30	·27	28	14	76·5	18	28·0	4	0
,,	Clifden (Kylemore House)..	...	...	...	...	...	...	...	...	...	...
XXIII.	Seaforde ...	·98	— 1·47	·33	31	8	73·0	29	35·0	4	0
,,	Londonderry (Creggan Res.)	1·99	— ·49	·44	27	16	...	...	...	...	...
,,	Omagh (Edenfel) ...	2·09	— ·34	·60	28	13	76·0	18	30·0	22	0

+ Shows that the fall was above the average; — that it was below it.

SUPPLEMENTARY RAINFALL, MAY, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	·67	XI.	New Radnor, Ednol	·58
,,	Ramsgate, West Cliff	1·15	,,	Rhayader, Nantgwillt	·69
,,	Hailsham	1·63	,,	Lake Vyrnwy	1·19
,,	Crowborough	1·23	,,	Ruthin, Plâs Drâw	·73
,,	Osborne	·37	,,	Criccieth, Talarvor	1·12
,,	Emsworth, Redlands	·39	,,	Anglesey, Lligwy	·92
,,	Alton, Ashdell	·86	,,	Douglas, Woodville	1·89
,,	Newbury, Welford Park	·66	XII.	Stoneykirk, Ardwell House	·84
III.	Harrow Weald	1·00	,,	Dalry, Old Garroch	2·36
,,	Oxford, Magdalen College	·88	,,	Langholm, Drove Road	3·37
,,	Banbury, Bloxham Grove	·41	,,	Moniaive, Maxwelton House	2·23
,,	Pitsford, Sedgebrook	1·63	XIII.	N. Esk Reservoir [Penicuick]	1·50
,,	Huntingdon, Brampton	1·26	XIV.	Maybole, Knockdon Farm	1·44
,,	Wisbech, Bank House	1·02	,,	Glasgow, Queen's Park	1·55
IV.	Southend	·80	,,	Campbeltown, Redknowe	1·51
,,	Colchester, Lexden	1·20	XV.	Inveraray, Newtown	3·70
,,	Saffron Waldon, Newport	1·09	,,	Ballachulish House	4·25
,,	Rendlesham Hall	1·41	,,	Islay, Eallabus	3·02
,,	Swaffham	1·42	XVI.	Dollar	2·57
,,	Blakeney	1·02	,,	Loch Leven Sluices	1·88
V.	Bishops Cannings	·33	,,	Balquhidder, Stronvar	3·12
,,	Ashburton, Druid House	·86	,,	Coupar Angus Station	1·83
,,	Okehampton, Oaklands	·43	,,	Blair Atholl	1·55
,,	Hartland Abbey	·12	,,	Montrose, Sunnyside	1·37
,,	Lynmouth, Rock House	·15	XVII.	Alford, Lynturk Manse	1·69
,,	Probus, Lamellyn	·71	,,	Keith	1·30
,,	Wellington, The Avenue	·33	XVIII.	N. Uist, Lochmaddy	1·25
,,	North Cadbury Rectory	·32	,,	Aviemore, Alvey Manse	2·01
VI.	Clifton, Pembroke Road	·11	,,	Loch Ness, Drumnadrochit	1·99
,,	Moreton-in-Marsh, Longboro'	·42	,,	Glencarron Lodge	4·85
,,	Rosz, The Graig	·36	,,	Fearn, Lower Pitkerrie	1·82
,,	Shifnal, Hatton Grange	·48	XIX.	Invershin	1·32
,,	Wem Rectory	·83	,,	Altnaharra	1·32
,,	Cheadle, The Heath House	·51	,,	Bettyhill	·98
,,	Coventry, Kingswood	·28	,,	Watten	1·13
VII.	Market Overton	·48	XX.	Cork, Wellesley Terrace	·90
,,	Market Rasen	·92	,,	Darrynane Abbey	1·46
,,	Bawtry, Hesley Hall	·43	,,	Glenam [Clonmel]	1·19
VIII.	Neston, Hinderton	·72	,,	Ballingarry, Gurteen	·84
,,	Southport, Hesketh Park	·31	,,	Miltown Malbay	1·29
,,	Chatburn, Middlewood	·55	XXI.	Gorey, Courtown House	1·09
,,	Cartmel, Flookburgh	1·47	,,	Moynalty, Westland	1·11
IX.	Langsett Moor, Up. Midhope	·51	,,	Athlone, Twyford	1·53
,,	Scalby, Silverdale	1·42	,,	Mullingar, Belvedere	1·19
,,	Ingleby Greenhow	1·00	XXII.	Woodlawn	1·38
,,	Middleton, Mickleton	·28	,,	Westport, Murrisk Abbey	1·15
X.	Beltingham	·75	,,	Crossmolina, Enniscoe	1·56
,,	Font Reservoir, Fallowlees	1·25	,,	Collooney, Markree Obsy	1·53
,,	Ilderton, Lilburn Cottage	·64	XXIII.	Enniskillen, Portora	1·72
,,	Keswick, The Bank	2·14	,,	Warrenpoint	·99
XI.	Llanfrechfa Grange	·28	,,	Banbridge, Milltown	1·31
,,	Treherbert, Tyn-y-waun	·66	,,	Belfast, Springfield	2·44
,,	Carmarthen, Friary	1·06	,,	Bushmills, Dundarave	1·79
,,	Castle Malgwyn	1·32	,,	Stewartstown	1·96
,,	Plynlimon	2·10	,,	Killybegs	1·22
,,	Tallyllyn	·20	,,	Horn Head	1·08

METEOROLOGICAL NOTES ON MAY, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A particularly fine and pleasant month. R fell on the first three and last two days, leaving the remainder of the month practically rainless. TS of moderate severity on the afternoon of 30th. Duration of sunshine 222·2* hours and of R 10·0 hours. Mean temp. 51°·1, or 1°·1 above the average.

ABINGER HALL.—A very dry month, with N.E. winds practically the whole time and much damage by frost, particularly on 25th. Rain was greatly needed and grass crops were very light.

TENTERDEN.—Wet at first, then three very dry weeks. Cold, with N. wind on 22 days. Damage by frost on 23rd, serious on low ground. Mean temp. 52°·5. Duration of sunshine 259·5† hours,

CROWBOROUGH.—Very cold nights with persistent N. and N.E. winds up to 23rd, then exceedingly warm. R ·95 in. below the average of 34 years, raising the deficiency since January 1st to 1·84 in. The dry weather, cold nights and E. winds retarded all vegetation, and hay prospects were not good. Mean temp. 52°·5.

HARTLEY WINTNEY.—Stormy and rough on 1st, but afterwards exceedingly harsh and dry. TS on 31st. Ozone on 23 days; mean 3·0.

ADDINGTON MANOR.—Much damage was done by frost on 23rd, when the grass thermometer fell to 22°.

PITSFORD.—From 5th to 25th there was a continuance of cold N. wind. R was very much needed. R ·42 in. below the average. Mean temp. 51°·6.

COLCHESTER.—Almost continuous N. to E. wind from 4th to 23rd, yielding cold, bright and very dry weather. Hot and close from 28th to 30th.

RENDLESHAM HALL.—Heavy R and gale on the first two days, then dry with N. to N.E. winds, ending on 22nd with S, H and R storms and frost. The last days were mild and showery.

BURY ST. EDMUNDS.—Very dry and cold, with northerly wind on 23 days. Between 3rd and 29th only ·08 in. of R fell. Gardens and fruit were much injured by frost on 23rd.

BRUNDALL.—Mean temp. about the average, the warm days in the last week compensating for the extremely cold ones immediately preceding. The 29th was the warmest day in May since 1895.

TORQUAY.—Duration of sunshine 288·3* hours. Mean temp. 53°·0, or 0°·1 below the average. Mean amount of ozone 5·6: max. 9·0 on 1st and 2nd; min. 4·0 on several days.

POLAPIT TAMAR.—Exceptionally dry, with very low temp. at night.

LYNMOUTH.—Except the first two days and the last four, it was dry and very sunny, with cool winds keeping the temp. low. R 2·86 in. below the average of 9 years.

WELLINGTON.—Abnormally dry and fine, but the nights were generally cold. R only about one-fifth of the average.

NORTH CADBURY.—The driest month since the record commenced in September, 1896. Humidity and cloud much below the normal, and a pleasant sunny month, though bad for gardens and grass. Disastrous frost on 23rd.

CLIFTON.—Practically rainless and the driest May in 50 years, the nearest approach being in 1876, with ·23 in. Cold from 21st to 23rd, with N.E. wind and frost. Last week warm.

ROSS.—The driest May since 1896. Generally very fine, but the severe frost of 22nd did considerable injury to fruit and vegetables. Temp. about the average, and R about one-sixth of average.

BOSTON.—Frost on 23rd did an immense amount of harm to early potatoes, vegetables and strawberries. Very high temp. from 28th to 30th.

WORKSOP.—The driest May for at least 30 years, practically nothing falling after the 3rd. Frost on 23rd did much damage, especially to ash plantations. Min. on grass 16°·5.

BOLTON.—Very dry, warm and sunny, and vegetation in exposed places suffering from want of R. Mean temp. 50°·8, or 1°·1 above the average. Duration of sunshine 162·1* hours, or 6·3 hours above the average.

SOUTHPORT.—The driest May in 34 years. Mean temp. 0°·3 above the average. Duration of sunshine 6 hours above the average. R 1·81 in. below the average.

UPPER MIDHOPE.—R 1·77 in. below the average of 10 years and the lowest in any month in that period.

LILBURN.—Remarkably dry. Cold in the early part and hot in the latter.

LLANFRECHFA GRANGE.—Very dry and R much wanted. Frost on 21st and 22nd did much harm to fruit blossom. Very warm on the last three days.

HAVERFORDWEST.—Fine but cold. Considerable damage was done by frost and vegetation was backward. Duration of sunshine 254·5* hours. One sunless day.

GOGERDDAN.—Very dry and cold, with keen E. and N.E. winds.

DOUGLAS.—Very fine with excessive sunshine, but strong, cold polar winds, the only genial period being from 14th to 18th. Absolute drought from 7th to 24th, with hot sun, parching wind and cold nights.

SCOTLAND.

LANGHOLM.—R ·38 in. above the average of 28 years.

LILLIESLEAF.—Cold E. winds. Quite fine for the first three weeks, then R. Cold nights. Beautiful weather for garden and farm and no damage from frost.

COLMONELL.—R the least in May with three exceptions since observations commenced. Frost on 25th did little damage near the shore.

COUPAR ANGUS.—Dry with bright sun to 23rd, then after three days with night frosts mild weather with daily R and high night temp. R ·09 in. below the average.

DRUMNADROCHIT.—R ·07 in., and rainy days 3, below the average of 19 years. Bitterly cold N. and E. winds.

DUNROBIN CASTLE.—Cold easterly winds in the early part. After 22nd milder, with occasional genial R to the end.

IRELAND.

CORK.—R only about one-third of the average. Mean temp. slightly above the average. Prevailing wind N.E. and N.W.

DARRYNANE ABBEY.—A dry month, the R being 59 per cent. of the average of 25 years. The first part was very dry and hot.

DUBLIN.—After opening with a downpour, the month proved to be one of drought. Polar winds largely predominated.

BELFAST.—A glorious month and the finest spell since May, 1901. Heavy falls in the latter days almost brought the R up to the average.

OMAGH.—All the R fell in the first and last weeks, the intermediate period being dry, mostly cloudless and warm, sometimes hot. Severe frost on 22nd, occasioning injury to all tender vegetation and fruit blossom, which the R of the last week did much to restore.

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* Campbell-Stokes. † Jordan

Climatological Table for the British Empire, December, 1904.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	56·3	29	27·6	9	45·2	36·6	38·9	92	68·3	19·9	1·79	18	7·7
Malta	67·2	3	41·2	31	60·4	49·2	46·5	76	107·8	35·8	2·30	12	5·1
Lagos	91·5	30	70·0	25	87·4	74·1	74·1	76	138·0	65·0	·73	1	2·7
Cape Town	92·9	30	49·1	26	75·0	57·4	54·6	67	...	...	1·51	5	3·4
Durban, Natal	85·5	8, 18	56·0	14	78·9	63·9	...	...	149·0	...	6·44	19	6·9
Johannesburg	81·8	29	40·0	15	72·0	52·6	49·9	68	145·5	39·5	3·27	5	4·6
Mauritius	88·2	26	65·4	6	85·5	70·8	67·2	71	153·2	57·4	4·06	16	6·2
Calcutta	81·4	11	50·9	27*c*	78·0	57·8	57·6	71	136·9	44·9	·00	0	2·0
Bombay	87·7	23	65·9	30	84·6	69·9	64·6	67	137·9	56·5	·00	0	2·0
Madras	87·7	1	62·7	27	83·7	69·6	65·4	72	141·2	59·7	·85	9	3·6
Kodaikanal	71·4	1	43·1	15	61·2	47·4	49·6	74	124·6	30·7	2·90	9	4·2
Colombo, Ceylon	90·2	8	70·0	24	86·1	72·8	73·6	78	153·2	66·0	2·12	9	5·0
Hongkong	75·7	8	44·8	24	66·1	55·7	48·1	62	125·5	...	·23	4	4·5
Melbourne	102·0	24	44·7	22	78·1	53·4	48·7	55	160·2	33·2	·11	3	4·7
Adelaide	114·0	31	47·1	19	85·6	59·0	49·7	46	161·0	42·4	·00	0	3·4
Coolgardie	108·6	27	53·2	24	93·0	62·2	51·8	42	174·6	49·4	·81	5	3·2
Sydney	107·5	31	57·5	2	79·9	64·5	59·8	63	138·1	47·0	·88	9	5·5
Wellington	69·8	2	43·0	16	61·5	50·2	47·4	72	128·0	38·0	5·38	17	7·3
Auckland	73·0	20*a*	48·0	14*d*	64·8	52·9	50·4	74	141·0	41·0	3·56	12	5·9
Jamaica, Negril Point.	87·6	2	65·9	31	85·1	70·3	70·6	79	...	...	4·64	4	...
Grenada	83·8	9*b*	71·0	11	82·2	73·2	69·8	71	150·0	...	7·59	21	5·6
Toronto	48·5	23	1·3	14	29·4	15·1	18·8	80	65·8	−5·2	1·45	13	8·9
Fredericton	38·9	20	−20·8	25	20·6	0·2	−2·0	58	...	...	1·80	...	4·6
Winnipeg	40·2	30	−29·6	24	16·5	−4·2	...	...	...	...	1·65	...	6·3
Victoria, B.C.	55·6	29	28·2	25	47·2	40·5	40·0	86	...	...	4·71	24	8·5
Dawson	21·5	3	−36·4	26	5·1	−4·5	...	...	...	...	1·45	5	5·7

a—and 21. *b*—and 10, 31. *c*—and 28. *d*—and 15.

MALTA.—Mean temp. of air 54°·4, or 1°·8 below average, mean hourly velocity of wind 10·4 miles, or 0·7 below average. Mean temp. of sea 59°·4. T88 on 5th.

Mauritius.—Mean temp. of air 0°·5, dew point 0°·4, and R ·73 in., below averages. Mean hourly velocity of wind 8·9 miles, or 1·9 below averages; mean computed direction of wind E. by N.

MADRAS.—Bright sunshine 173·2 hours.

KODAIKANAL.—Bright sunshine 173 hours.

HONGKONG.—Mean temp. of air 60°·7. Bright sunshine 201·7 hours. Mean hourly velocity of wind 10·6 miles; mean direction E. 20° N.

Adelaide.—Mean temp. 0·9 above average. No rain; the driest December on record.

Sydney.—Mean temp. of air 2°·2 above, R 1·62 in. below, and humidity 6·0 below, averages.

Wellington.—Mean temp. of air 4°·1 below, R 2·12 in. above, averages.

Auckland.—Mean temp. of air 6°·0 below the average of the previous 36 years, and R 1·00 in. above average.

Symons's

Meteorological Magazine.

No. 474. JULY, 1905. Vol. XL.

THE NEW CONSTITUTION OF THE METEOROLOGICAL OFFICE.

We are now able to give on official authority the new arrangements made by the Government for carrying on the meteorological service of the United Kingdom. The information was contained in a Treasury Minute dated May 20th, 1905, which, after a question on the subject was asked in the House of Commons by Sir J. Batty Tuke, M.P. for the Universities of Edinburgh and St. Andrews, was issued on June 21st as a Parliamentary Paper under the reference number [Cd. 2559.]

The Minute runs as follows :—

My lords resume consideration of the report of the committee presided over by Sir Herbert Maxwell on the administration of the Meteorological Office.

Since the issue of the report my lords have been in communication with the Royal Society, the Board of Admiralty, the Board of Trade, and the Board of Agriculture and Fisheries, and they are now in a position to place on record the conclusions at which they have arrived.

1. The Meteorological Office will, as from the 1st April, 1905, be placed under the management of a committee constituted as follows :—

The director of the Meteorological Office.

Two members nominated by the Royal Society.

The hydrographer of the Navy.

One member nominated by the Board of Trade.

One member nominated by the Board of Agriculture and Fisheries.

One member nominated by the Treasury.

The members of the committee will be appointed by the Treasury and, subject to the discretion of the authorities by which they are respectively nominated, will hold office for a period not exceeding five years, but will be eligible for re-appointment.

2. The director will be appointed by the Treasury, and will receive out of the grant-in-aid a salary of £800, rising after five years to £1,000 per annum, without a title to pension. He will hold office for a period of five years, but, like the other members of the committee, will be eligible for reappoint-

ment until he attains the age of 65. The present director will receive the *maximum* of the scale, namely, £1,000 per annum, from the 1st April, 1905.

3. Subject to the general control of the committee and to such regulations as may be laid down by the Treasury, the director will be responsible for the administration of the office.

4. The director will act as chairman of the committee, and will summon it at such times as he considers it desirable; but four meetings at least shall be held during the year.

5. The members of the committee will not receive remuneration for their services, but travelling and subsistence expenses will be allowed in the case of members not residing in the metropolis.

6. My lords will ask Parliament annually to vote a grant-in-aid of the expenses of the office. For the present this grant is fixed at £15,300.

7. The grant will be administered by the committee, who may, with the consent of the Treasury, delegate to the director such powers of expenditure as they consider proper. All cheques will be signed by the director and countersigned by a member of the committee.

8. The committee will make an annual report for presentation to Parliament, and will at the same time transmit to the Treasury a statement of their accounts in such form as may be prescribed. In December of each year the committee will submit a statement showing the manner in which it is proposed to apply the grant for the ensuing financial year.

9. The staff will be appointed and their salaries fixed by the committee on the recommendation of the director.

10. In the absence of the director the committee may appoint one of its members to act as interim director.

11. My lords are pleased to appoint the following gentlemen to be members of the committee:—

Mr. W. N. Shaw, Sc.D., F.R.S., Director.

Capt. Arthur M. Field, R.N., Hydrographer to the Navy.

Capt. A. J. G. Chalmers, Professional Officer of the Marine Department, Board of Trade.

Mr. W. Somerville, Sc.D., Assistant Secretary of the Board of Agriculture and Fisheries.

Professor G. H. Darwin, F.R.S., University of Cambridge.

Professor Arthur Schuster, F.R.S., University of Manchester.

Mr. G. L. Barstow, nominated by the Treasury.

The result is to abolish the exclusive control exercised by the Royal Society through the Meteorological Council, to do away with the anomalous and undignified constitution of the Council as a limited company with dummy shareholders, and greatly to simplify the working of the Meteorological Office. So far the recommendations of Sir Herbert Maxwell's Committee * have been carried out; but they have not been carried out fully. The Meteorological Office is not placed under the Board of Agriculture and Fisheries as was recommended, and the staff of the Office are denied the status and privileges of civil servants, though accorded the civil service liability to compulsory retirement at an age-limit (without the pension that

* See this Magazine, vol. **39**, p. 101.

reconciles the privileged official to conclude his active service). The Office is now under the control, though we gather that this control is advisory and not executive, of a composite Committee representing one learned society and four different government departments. So far as the composition of the new Committee is concerned it is simply the old Meteorological Council with the place of the unofficial meteorologists, who were formerly upon it, taken by government officials, and with the former Secretary as Chairman. We consider that it is a blot on the re-organization that the Royal Meteorological Society is not recognized so far as to be invited to nominate one member of the Committee. Apart from this we have no criticisms to offer. The gentlemen who form the Committee are of the highest standing and of tried administrative ability. The Director, the Hydrographer, and Professors Darwin and Schuster can be trusted to preserve all that was best in the old Council of which they were members. Professor Schuster said in evidence to the Treasury Committee that he became a member of the Meteorological Council reluctantly "and should not in future remain one if the constitution of the office were not reorganised," indicating that the Committee should be advisory and the Director of the Office given more freedom. As he is a member of the new body we take it that these reforms have been made. The Marine Department of the Board of Trade is rightly represented since so very large a share of the meteorological observations at sea are made by captains of the mercantile marine. The Board of Agriculture and Fisheries contains no official better fitted for a place on the Committee than Dr. Somerville, whose distinguished career as Lecturer on Forestry and Professor of Agriculture successively in the Universities of Edinburgh, Durham and Cambridge, has given him exceptional opportunities for appreciating the bearings of meteorology on agriculture. Mr. Barstow acquired a thorough knowledge of the working of the old Council and of the views of those who wished for reform when he acted as Secretary of Sir Herbert Maxwell's Committee.

The most satisfactory feature in the Committee is the Director, who as chairman, and no longer as secretary, will be more favourably placed for applying his experience and knowledge to the improvement of the weather service in all its branches, including, we have reason to hope, a great development of meteorological research.

Although the opportunity has not been fully utilized and further changes will be necessary in the future, we gladly recognize that the action of the Government has started a movement in the right direction.

Though looking forward to the achievements of the new body we must not forget a backward glance at the old Meteorological Council, the members of which, and especially the Chairman, General Sir Richard Strachey, did good service in their generation, and we miss any expression of thanks to them in the Treasury Minute which we have re-printed.

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Correspondence.

To the Editor of Symons's Meteorological Magazine.

A LOW FREEZING POINT.

I HAVE occasionally exposed vessels of clear rain water upon the grass during cold winter nights when the atmospheric conditions were quiet enough. The lowest temperature I have ever observed in these without freezing is as nearly as possible 27°. There is some uncertainty in the exact temperature because a very small movement of the thermometer causes the water to change at once into ice at or near 32°. I have also exposed water in bottles which has remained liquid at temperatures below 30°, but which has changed to ice during the act of pouring it out. From these, and previous experiments described by others, I had a notion that under ordinary atmospheric conditions a water temperature below 26° was probably not to be expected. On Friday night, June 9th, at 11.45 p.m., however, the sky being clear and the air quite still, a radiation thermometer lying on the grass and reading 23°·5 was covered with what was undoubtedly dew. A quarter of an hour later the reading had fallen to 22°·8, and the dew had changed to thick hoar frost. The thermometer was quite accurate and in good order. Do you know of any observations similar to this?

J. R. SUTTON.

Kenilworth, Kimberley, June 12th, 1905.

[In this Magazine for February, 1897 (Vol. **32**, p. 1), a description is given of experiments made in order to account for the water in a wet-bulb glass remaining unfrozen at 28° even when stirred; and having probably been cooled to 25°, or nearly so, without freezing. The laboratory experiments showed that ordinary distilled water could be cooled to 12°·3 F. without freezing, "then the whole froze with a sort of flash, and temp. rose to 31°·8." The cooling of water far below the freezing point without solidifying is referred to in most books on chemical physics, 10° F. being the extreme we have noted.—ED. *S.M.M.*]

PARTIAL DROUGHT.

A PARTIAL drought lasted here from May 3rd to June 17th inclusive, the amount registered being ·34 in. in 46 days, measurable quantities falling on 12 days. On the 40 days May 8th to June 16th inclusive ·16 in. only fell; and on the 14 days from June 2nd to 15th inclusive there was no measurable rain. The record for May 2nd was ·29 in., and for June 18th, ·57 in. On this latter date there were two thunderstorms (without lightning), which is the first record of either thunder or lightning at this station since August 30th, 1904. Total fall September, 1904, to May, 1905, inclusive, 11·02 ins. being 7·84 in. less than the average. T. W. BACKHOUSE.

West Hendon House, Sunderland, June 19th, 1905.

ON the 1st inst. I reported to you a partial drought of 28 days—very rare in these parts.

Since then it has become a partial drought of 44 days reaching from 3 p.m. on the 3rd May to 8.30 a.m. on 17th June—or 44 days —17½ hours.

Our rainfall in that period has been :—

		in.
May	7	·011
,,	10	·018
,,	23	·010
,,	25	·011
,,	31 (falling on June 1)	·120
June	1	·153
,,	2	·036
,,	6	·006
,,	7	·007
,,	10	·004
,,	12	·063
	Total ...	·439

We are thankful to-day at last to welcome rain though it may spoil the hay harvest.

EDWARD PEARSON.

Parksyde, Wilmslow, June 17th, 1905.

HEAVY RAIN IN JUNE AT HASLEMERE.

THE rain during June, 1905, has been unusually heavy, and may be worth a record in the *Meteorological Magazine*. On the 5th rain began to fall at 7 a.m., and when the observations were taken at 8 a.m., there was ·07 in. in the gauge ; the rain continued all day and night ; at 8 a.m. on the 6th 1·75 in. was recorded ; rain and drizzle continued during the 6th, but it was at no time heavy. It was a wet week, as the following will show :—

		in.	
June	4th	·07	practically continuous
,,	5th	1·75	
,,	6th	·43	
,,	7th	·24	
,,	8th	·03	
,,	9th	·20	
,,	10th	·51	
,,	11th	·14	
,,	12th	1·57	(Whit Monday)
Total of nine days...		4·94 in.	

Whit Monday morning was misty and rainy, clearing to bright, hot sunshine about 2 o'clock ; numbers of people were tempted out in summer clothes to local festivities. About 4 p.m. heavy rain began, accompanied, half an hour later, by thunder and lightning. At 5.30 p.m. there was 1·30 in. in the gauge. Mr. Penfold writes of

this storm, at Courts Hill, one mile S.E. from Hazelhurst, "The heavy rain was from 4.0 to 5.5 p.m.; 1·50 in. must have fallen in that time along this side of the valley." His record for the 24 hours is 2·48 in. The Hazelhurst fall was 1·57 in.; a difference of nearly an inch within a distance of one mile. The road was flooded in one place 4 feet deep, and much injury has been done to roads in the district where the rain was heaviest. Mr. Penfold reports 5·80 in. for the nine days.

On turning back for wet periods of eight days, I find that 4·94 in. in nine days has only once been exceeded at Hazelhurst, viz., in 1899, when from November 2nd to 9th (eight days) 6·63 in. fell.

The average rainfall of June (1891-1900) is 2·26 in.: the total of June, 1905, was 6·47 in., exceeding the average by 4·21 in.

Falls of 2 inches or above have occurred as under:—

	in.	
July 29th, 1894	2·00	(Hazelhurst)
September 1st, 1896	2·06	(,,)
September 29th, 1898	2·17	(,,)
November 23rd, 1898	2·35	(,,)
November 3rd, 1899	2·11	(,,)
June 12th, 1905	2·48	(Courts Hill)

T. P. NEWMAN.

Hazelhurst, Haslemere, Surrey.

RAINFALL OF JULY 9th.

I THINK the rainfall on Sunday, July 9th, during a severe thunderstorm, may interest you. The fall for the 24 hours amounted to 1·67 in., and I add particulars:—

Storm began 3.8 p.m.

3.8 to 4.8	1·14	in.
4.8 to 5.28	·10	,,
5.30 to 6.30	·39	,,
6.30 to 7.20 (rain ceased)	·03	,,
During night	·01	,,
Total	1·67	,,

G. C. LAWSON.

Mayfield House, nr. Ashbourne, Derbyshire, July 10th 1905.

RAINFALL at Hill House, Harrow Weald, was yesterday 2·21 in., which fell between 11.50 a.m. and 4.30 p.m., 1·18 in. fell between 11.50 and 1.30 p.m., and 1·03 in. between 3.30 and 4.30. It was the heaviest fall during the last 15 years.

ALEX. CROSSMAN.

10th July, 1905.

THE rain to-day commenced at 1 p.m. here, and in 50 minutes we had a fall of 2·44 in. It resumed at 3.30 p.m. and added ·11 in.; total 2·55 in. We seem to have been near the centre as two neighbours, 500 yards away in different directions, had under 2 inches.

JOHN McEWAN.

Carisbrooke, Enfield, 9th July, 1905.

A FEW particulars of the exceptional storm in this district yesterday (Sunday) may be of interest. :—

The morning was a very sultry one, the shade temp. reading being as high as 82° by 11 a.m. At this time large massive cumuli were rapidly forming, and about 11.20 a.m., thunder was first heard in the S.W., and from this time until 6 p.m. thunder and lightning were more or less incessant at greater or less distances. At 12.40 p.m. the first rain fell, the sky being almost completely overcast, the exception being to the N.E., where the sky was clear, the surface wind at the time being easterly, strong and gusty in force. Rain continued in moderate showers until 1 p.m., the measurement then being ·11 in. At 1 p.m. the wind suddenly calmed, the sky being very black at the time and the storm burst right overhead, the first flash of lightning being of exceptional intensity, the thunder, following immediately, being very loud and "crackly." From this time (1 p.m.) until 1.30 p.m. the storm was practically overhead, rain falling to the amount of ·64 in. At 1.30 p.m., for a brief moment the wind shifted to S.W. and lulled to a calm. This, however, was but very temporary, as the storm immediately afterwards burst with terrific fury, the wind shifting to the S.E. and blowing with hurricane force, while rain and hail fell with almost indescribable fury, the latter coming down in an apparently solid sheet, the stones being large, but not exceptionally so. At 1.49 p.m. the storm suddenly ceased, the wind calmed and the clouds passed away to the N.E. On examining the gauge it was found that between 1.30 and 1.49 p.m., or a period of 19 minutes, 1·05 in. had been collected therein, but so violent was the hail, and so terrific the force of the rain and wind that it is highly probable that the gauge did not collect anything like the amount that actually fell in this time, not because of the gauge *overflowing*, but by reason of the hail and rain (the drops were abnormally large) striking the gauge with such force as to bounce out again, this of course applying especially to the hail, which even when it falls in slight showers is very difficult to measure. As a check to the measurement of the rain gauge, a tank, which before the storm was quite empty, was measured and found to contain 32 ins. of rainfall when measured in usual glass for 5 in. rain gauge. This tank is elliptical in shape, has an outside circumference of 70 ins, and stands on wheels, slightly raised from the ground, while the distance from the *top* of the tank to the ground is 32 ins., the tank itself being 22½ ins. deep and perfectly level.

Perhaps, from the foregoing details you will be able to make out what the actual rainfall was, as registered by the tank. I would ask you to note carefully that the 32 ins. of rain collected by the tank fell between 12.40 p.m. and 6 p.m., while the amount collected by the ordinary gauge during that time was 1·96 in., made up as follow: —

Time.		Inches.
12.40 to 1 p.m.	.....	·11
1 ,, 1.30 p.m.	.....	·64
1.30 ,, 1.49 ,,	.....	1·05
		1·80
3.40 ,, 4 ,,	.....	·03
4.57 ,, 5.10 ,,	.....	·12
5.30 ,, 6.10 ,,	.....	·01
	Total...	1·96

As before stated, at 1.49 p.m. the storm passed away to the N.E., but for the rest of the day until 6 p.m., thunder and lightning were never very far from us, and as will be seen from the table above, several showers fell during the afternoon.

During the storm temp. fell from 82° to 56° but afterwards rose considerably. There was much flooding in this district; the cellars of this house were flooded. Great damage was also done by the hail.

HAROLD E. FREIR.

Bylock Hall, Ponders End, July 10th, 1905.

At Camden Square the lightning was extremely vivid, and the thunder remarkably loud and continuous, but the rainfall was comparatively small. The total for the day was ·31 in. with a total duration of 1 hour, the fall occurring in three well defined showers, the first at 0.50 p.m., being short and sharp, the second from 1.10 to 1.20 p.m. giving a greater fall with rather less intensity, and the third at 5.15 p.m. being comparatively slight.

The rain varied greatly, and little or none was recorded in the western suburbs. The storm raged with great fury on Hampstead Heath and in the suburbs, where a considerable amount of damage was done by lightning and two lives were lost. Thunderstorms appear to have occurred on this day in all parts of Great Britain.—H. R. M.

A SMALL WHIRLWIND.

A somewhat unusual phenomenon occurred here yesterday at 11.45 a.m. I was seated on a piece of sloping ground, 250 yards west of Newton Racecourse, when there was a sudden noise as of an explosion, and on looking to the direction of the Grand Stand (east)

I heard all the doors banging, and windows rattling, and people coming helter skelter towards me. The wind had suddenly gathered in a sort of huge whirlwind all the dust, paper, and light materials, and was whirling it round and round at a terrific rate within a 50 yards circle. I was not more than ten yards from the edge of the wind's operations, and some pieces of paper were carried a quarter of a mile, at an altitude of fully 100 feet. The air was soft and the breeze quiet before the incident occurred. Immediately afterwards, there came over a shivering coldness in the atmosphere, but during the next hour the original conditions were gradually restored. I enquired of men whom I saw coming from the direction the disturbance pursued, and they all testified that they had not before seen anything like it.

T. E. CLOUGH.

Town Hall, Earlestown, June 5th, 1905.

ROYAL METEOROLOGICAL SOCIETY.

THE final Meeting of the session was held on Wednesday afternoon, June 21st, at the Society's rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. George C. Simpson read a paper on the "Normal Electrical Phenomena of the Atmosphere." In no branch of physics has the discovery of ions, electrons, and radio-activity produced a greater revolution than in that devoted to atmospheric electricity. Mr. Simpson in this paper stated with striking clearness the chief lines along which investigations have been made during the last few years and the conclusions arrived at, and also pointed out some of the problems awaiting solution. The amount of radio-active emanation in the lower regions of the atmosphere is increased by all those meteorological conditions which tend to keep the air stagnant over the Earth's surface. The meteorological conditions which either cause or often accompany stagnant air are calm, low temperature and high relative humidity; while, on the contrary, high winds, high temperature and low humidity generally accompany the mixing of large masses of air. This all agrees with the observed facts that the atmospheric radio-activity increases with falling temperature, rising humidity, and increasing wind strength. Mr. Simpson is of the opinion that a solution of the problems of atmospheric electricity can only be expected from the results of extended measurements in the atmosphere itself, and from laboratory experiments directed towards the problems.

The President, Dr. W. N. Shaw, Mr. W. B. Tripp, Captain A. Carpenter, Mr. R. Strachan, and Mr. C. Beadle, took part in the discussion, and Mr. Simpson was heartily thanked for his paper.

A paper by Mr. S. P. Fergusson on "Two New Meteorological Instruments," was, in the absence of the author, read by the Secretary. The instruments described were: An Automatic Polar Star Light

Recorder, for measuring the amount of cloudiness at night by the obscuration of the pole-star; and an Ombroscope for determining with great exactness the time of commencement and the duration of rain. Both of these instruments are in use at the Blue Hill Observatory, Mass., U.S.A.

Dr. S. M. W. Bodie, Mr. L. A. Crosse, Mr. R. M. Kerr, Captain H. G. Lyons and Mr. F. Sadler were elected Fellows of the Society.

METEOROLOGY AND AGRICULTURE.

In the May number of this Magazine reference was made to a scheme which the Council of the Royal Meteorological Society had under consideration for the extension of the knowledge of Meteorology amongst Local Scientific and other Societies. A practical demonstration of the utility of such a scheme was given at the Royal Agricultural Society's Show, at Park Royal, from June 27th to 30th.

An Agricultural Education and Forestry Exhibition has been held in connection with the last few annual Shows. This year it was decided to include a section of Meteorology, and the Royal Meteorological Society was invited to undertake the arrangements for this new departure.

A typical climatological station was set out in the grounds adjoining the Exhibition, an enclosure twenty feet square being railed off and the following instruments placed in position: viz.—1. Stevenson Thermometer Screen, fitted with dry bulb, wet bulb, maximum and minimum thermometers; 2. Snowdon Rain gauge; 3. Black and bright bulb solar radiation thermometers; 4. Grass minimum thermometer; 5. Campbell-Stokes' Sunshine recorder; and 6. Earth thermometers (1 and 4 feet). The visitors were greatly interested in watching the sunshine recorder at work, and in learning that the temperature of the soil at a depth of 4 feet was 10° lower than at 1 foot.

In the Exhibition there was arranged an interesting collection of diagrams, maps, charts and photographs lent by the Royal Meteorological Society, Dr. W. N. Shaw, Dr. H. R. Mill, and Mr. W. Marriott. A number of self-recording and other instruments used for meteorological purposes were lent by Messrs. Negretti and Zambra, Mr. J. J. Hicks, and Mr. F. L. Halliwell. A specially drawn Weather Map, together with the Forecasts, was posted up about noon each day.

Mr. W. Marriott gave an address each afternoon on "Meteorology in relation to Agriculture."

On Tuesday the Prince of Wales spent some time in looking over the exhibits, and on Wednesday the King and the Princess Victoria visited the Show and were much interested in the meteorological part of it.

SIX MONTHS' RAINFALL OF 1905.

Aggregate Rainfall for January—June, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	12·45	117	Bolton	16·88	101	Braemar	14·51	97
Tenterden	14·36	124	Wetherby.....	8·87	76	Aberdeen	11·74	86
Hartley Wintney	12·42	107	Arncliffe	23·45	89	Cawdor	14·30	120
Hitchin	12·07	118	Hull	9·06	81	Invergarry ...	29·72	120
Winslow	10·23	91	Newcastle.....	7·28	64	Bendamph ...	39·37	109
Westley	12·14	118	Seathwaite ...	56·94	99	Dunrobin	15·25	113
Brundall	10·78	107	Cardiff, Ely ...	15·77	92	Killarney ...	23·15	89
Alderbury	15·03	121	Haverfordwest	18·54	94	Waterford ...	16·93	98
Winterbourne ...	13·53	83	Gogerddan ...	19·40	110	Broadford.....	15·32	108
Torquay	13·57	90	Llandudno ...	11·37	93	Carlow	13·41	89
Polapit Tamar ...	15·28	99	Cargen	18·03	92	Dublin	10·21	86
Bath	11·13	85	Lilliesleaf	...	..	Mullingar.....	14·39	93
Stroud, Upfield...	13·43	105	Colmonell	16·37	87	Ballinasloe ...	13·16	83
Woolstaston	13·34	93	Glasgow	11·73	79	Clifden	30·31	88
Bromsgrove	9·28	88	Inveraray	31·54	119	Crossmolina ...	21·00	97
Boston	10·13	104	Islay, Eallabus	21·69	111	Seaforde	14·14	84
Hodsock Priory..	7·80	72	Mull	25·03	105	Londonderry..	16·80	98
Derby	8·13	71	Dundee	8·75	72	Omagh	17·17	108

REVIEW.

Twenty Years on Ben Nevis. By WM. T. KILGOUR. Paisley: Alexander Gardner. Size 7 × 5. Pp. 154. Price 1s. 6d. net.

A PLEASANTLY written popular account of life and work at the high level Observatory. The illustrations are numerous and well chosen. We quote with some sympathy the author's closing words of preface :—

"Doubly repaid would the Author deem himself if, as a result of the publication of this small work, an indulgent public would agitate for the re-opening of Ben Nevis Observatory, the abandonment of which in this enlightened age when other countries are devoting so much of their wealth towards the propagation of meteorological research, is, to Britons, alike discreditable and unpatriotic."

We do not, however, consider that public agitation will do any good. The public ceased to care enough about the subject to find the money for continuing the work, otherwise it would never have stopped.

RAINFALL AND TEMPERATURE, JUNE, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.
		inches	inches.	in.						
I.	London (Camden Square) ...	4·39	+ 2·30	·87	5	17	81·9	22	46·2	7
II.	Tenterden ...	5·26	+ 3·30	1·47	29	17	75·0	22*a*	48·0	7
,,	Hartley Wintney ...	4·69	+ 2·80	·96	5	15	79·0	22, 25	45·0	7
III.	Hitchin ...	3·29	+ 1·40	·94	6	12	...	...	...	...
,,	Winslow (Addington) ...	3·18	+ 1·19	·81	6	14	81·0	27	45·0	7, 9*c*
IV.	Bury St. Edmunds (Westley)	4·24	+ 2·20	1·20	17	14	78·0	27	45·0	15
,,	Brundall ...	3·13	+ 1·24	1·00	5	16	77·3	16	42·6	1
V.	Alderbury ...	4·23	+ 2·14	1·23	6	14	86·0	22	35·0	14
,,	Winterbourne Steepleton ...	1·93	— ·39	·79	5	14	76·5	25	42·0	14
,,	Torquay (Cary Green) ...	2·77	+ ·64	·61	16	17	75·9	25	46·9	9
,,	Polapit Tamar [Launceston]	1·72	— ·40	·34	29	20	75·0	22*b*	36·0	14
,,	Bath ...	3·48	+ 1·17	·72	12	16	78·0	22	44·0	9
VI.	Stroud (Upfield) ...	4·15	+ 1·92	1·08	30	19	78·0	25	45·0	8
,,	Church Stretton (Woolstaston)	3·18	+ ·72	·90	30	16	77·0	28	36·0	9
,,	Bromsgrove (Stoke Reformatory)	2·35	+ ·28	1·04	30	11	79·0	22	40·0	4, 9
VII.	Boston ...	2·66	+ ·72	1·57	17	15	80·0	27	45·0	10
,,	Worksop (Hodsock Priory).	2·41	+ ·17	1·13	17	11	77·4	25	35·6	5
,,	Derby (Midland Railway)...	2·39	— ·31	·76	17	14	84·0	25	43·0	4, 9
VIII.	Bolton (The Park) ...	2·93	— ·28	1·18	17	12	78·5	25	42·6	9
IX.	Wetherby (Ribston Hall) ...	1·05	— 1·33	·50	17	6	...	...	...	...
,,	Arncliffe Vicarage ...	2·42	— 1·27	·90	17	7	...	...	...	...
,,	Hull (Pearson Park) ...	2·28	+ ·16	·94	30	10	78·0	22	41·0	10
X.	Newcastle (Town Moor) ...	1·19	— ·84	·72	18	8	...	...	...	...
,,	Borrowdale (Seathwaite) ...	5·94	— 1·03	3·10	20	8	80·8	23	38·5	9, 11
XI.	Cardiff (Ely) ...	4·12	+ 1·59	·75	29, 30	19	...	...	...	...
,,	Haverfordwest (High St.)...	2·28	— ·33	·59	19	12	79·8	25	41·1	14
,,	Aberystwyth (Gogerddan)...	2·35	— ·58	·65	20	12	85·0	23	35·0	3
,,	Llandudno ...	1·94	— ·06	·77	17	11	77·0	23	44·0	11
XII.	Cargen [Dumfries] ...	2·00	— ·68	·92	20	5	82·6	23	38·0	9
,,	Lilliesleaf (Riddell) ...	...	...	..	...	...	...	...	...	...
XIII.	Edinburgh (Royal Observy.)	·91	...	·39	27	9	76·8	27	42·5	12
XIV.	Colmonell ...	1·76	— ·95	·47	18	6	83·0	23	35·0	10
XV.	Tighnabruaich ...	1·09	— 2·67	·28	20	7	73·0	23	40·0	5, 6*c*
,,	Mull (Quinish) ...	1·24	— 2·31	·69	19	7	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	·85	— 1·30	·30	27	8	77·5	27	39·7	7
XVII.	Braemar ...	1·41	— 1·03	·40	20	9	79·3	25	33·7	11
,,	Aberdeen (Cranford) ...	·76	— 1·33	·19	27	7	70·0	19, 27	32·0	10
,,	Cawdor (Budgate) ...	1·31	— ·93	·31	4	12	...	...	...	...
XVIII.	Invergarry ...	2·21	— ·64	1·16	5	5	...	...	...	...
,,	Bendamph ...	2·24	— 2·54	·74	20	9	...	...	...	...
XIX.	Dunrobin Castle ...	·86	— 1·28	·34	18	8	69·5	24	40·0	1
,,	Castletown ...	·79	...	·28	15	8	74·0	24, 27	40·0	9, 10*d*
XX.	Killarney ...	2·10	— 1·19	·46	21	13	80·0	25	41·0	7
,,	Waterford (Brook Lodge)...	1·88	— ·73	·46	19	10	77·0	26	38·0	4
,,	Broadford (Hurdlestown) ...	2·09	— ·43	·54	18	13	83·0	25	42·0	6
XXI.	Carlow (Browne's Hill) ...	1·35	— ·97	·31	20	10	...	...	...	...
,,	Dublin (Fitz William Square)	1·18	— ·77	·36	18	11	77·0	26	46·2	5, 11
XXII.	Ballinasloe ...	2·49	— ·20	·66	18	13	83·7	25	35·0	4
,,	Clifden (Kylemore House)..	3·07	— 2·26	1·00	21	9	...	...	...	...
XXIII.	Seaforde ...	3·08	+ ·36	1·49	18	10	85·0	23, 24	37·0	10
,,	Londonderry (Creggan Res.)	1·66	— 1·26	·87	18	13	...	...	...	...
,,	Omagh (Edenfel) ...	2·05	— ·83	·70	19	10	80·0	23, 26	40·0	5

+ *Shows that the fall was above the average*; — *that i was below it.* *a* and 27. *b* and 23, 25. *c* and 10. *d*

SUPPLEMENTARY RAINFALL, JUNE, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	5·61	XI.	New Radnor, Ednol	3·10
,,	Ramsgate, West Cliff	4·14	,,	Rhayader, Nantgwillt	...
,,	Hailsham	3·52	,,	Lake Vyrnwy	5·13
,,	Crowborough	4·39	,,	Ruthin, Plâs Drâw	1·92
,,	Osborne	4·29	,,	Criccieth, Talarvor	1·69
,,	Emsworth, Redlands	3·65	,,	Anglesey, Lligwy	2·10
,,	Alton, Ashdell	5·11	,,	Douglas, Woodville	3·22
,,	Newbury, Welford Park	4·74	XII.	Stoneykirk, Ardwell House	1·51
III.	Harrow Weald	3·26	,,	Dalry, Old Garroch	3·32
,,	Oxford, Magdalen College	3·51	,,	Langholm, Drove Road	2·35
,,	Banbury, Bloxham Grove	2·96	,,	Moniaive, Maxwelton House	3·10
,,	Pitsford, Sedgebrook	3·34	XIII.	N. Esk Reservoir [Penicuick]	1·45
,,	Huntingdon, Brampton	3·18	XIV.	Maybole, Knockdon Farm	1·59
,,	Wisbech, Bank House	3·59	,,	Glasgow, Queen's Park	·79
IV.	Southend	3·57	,,	Campbeltown, Redknowe	2·44
,,	Colchester, Lexden	3·23	XV.	Inveraray, Newtown	2·05
,,	Saffron Waldon, Newport	3·13	,,	Ballachulish House	3·78
,,	Rendlesham Hall	3·83	,,	Islay, Eallabus	1·42
,,	Swaffham	2·81	XVI.	Dollar	·65
,,	Blakeney	3·08	,,	Loch Leven Sluices	·38
V.	Bishops Cannings	3·86	,,	Balquhidder, Stronvar	...
,,	Ashburton, Druid House	3·79	,,	Coupar Angus Station	·91
,,	Okehampton, Oaklands	2·61	,,	Blair Atholl	2·71
,,	Hartland Abbey	1·47	,,	Montrose, Sunnyside	·56
,,	Lynmouth, Rock House	3·21	XVII.	Alford, Lynturk Manse	·51
,,	Probus, Lamellyn	2·41	,,	Keith	·47
,,	Wellington, The Avenue	3·21	XVIII.	N. Uist, Lochmaddy	1·36
,,	North Cadbury Rectory	3·69	,,	Aviemore, Alvey Manse	·95
VI.	Clifton, Pembroke Road	4·28	,,	Loch Ness, Drumnadrochit	·68
,,	Moreton-in-Marsh, Longboro'	4·54	,,	Glencarron Lodge	2·33
,,	Ross, The Graig	3·69	,,	Fearn, Lower Pitkerrie	·61
,,	Shifnal, Hatton Grange	1·78	XIX.	Invershin	·74
,,	Wem Rectory	2·59	,,	Altnaharra	2·44
,,	Cheadle, The Heath House	1·94	,,	Bettyhill	·76
,,	Coventry, Kingswood	3·66	,,	Watten	·72
VII.	Market Overton	4·21	XX.	Cork, Wellesley Terrace	2·42
,,	Market Rasen	1·28	,,	Darrynane Abbey	3·86
,,	Bawtry, Hesley Hall	2·22	,,	Glenam [Clonmel]	2·22
VIII.	Neston, Hinderton	2·56	,,	Ballingarry, Gurteen	1·35
,,	Southport, Hesketh Park	1·87	,,	Miltown Malbay	1·95
,,	Chatburn, Middlewood	3·47	XXI.	Gorey, Courtown House	1·46
,,	Cartmel, Flookburgh	2·63	,,	Moynalty, Westland	2·41
IX.	Langsett Moor, Up. Midhope	2·58	,,	Athlone, Twyford	1·45
,,	Scalby, Silverdale	·64	,,	Mullingar, Belvedere	1·79
,,	Ingleby Greenhow	1·49	XXII.	Woodlawn	1·55
,,	Middleton, Mickleton	·60	,,	Westport, Murrisk Abbey	1·85
X.	Beltingham	1·34	,,	Crossmolina, Enniscoe	2·15
,,	Font Reservoir, Fallowlees	1·70	,,	Collooney, Markree Obsy	1·83
,,	Ilderton, Lilburn Cottage	·50	XXIII.	Enniskillen, Portora	2·20
,,	Keswick, The Bank	2·98	,,	Warrenpoint	...
XI.	Llanfrechfa Grange	3·61	,,	Banbridge, Milltown	2·76
,,	Treherbert, Tyn-y-waun	8·59	,,	Belfast, Springfield	3·82
,,	Carmarthen, Friary	2·86	,,	Bushmills, Dundarave	1·47
,,	Castle Malgwyn	3·29	,,	Stewartstown	2·85
,,	Plynlimon	4·30	,,	Killybegs	1·54
,,	Tallyllyn	1·70	,,	Horn Head	2·72

METEOROLOGICAL NOTES ON JUNE, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—In spite of the persistent heavy R of the first half and the last two days of the month, there was a considerable amount of pleasant weather and brilliant sunshine. It was, however, seldom hot, the shade temp. reaching 80° on two days only. TS on 10th and T on 15th. Duration of sunshine 157·6 hours,* and of R 77·9 hours, the latter being 49·8 hours in excess of the average. Mean temp. 61°·4, or 1°·0 above the average.

TENTERDEN.—By far the largest fall in June since 1860, the most before being 3·87 in. in 1896, whilst only five other Junes had over 3 inches. Duration of sunshine 179† hours; 8 sunless days. Wind N. or E. on 20 days. Max. temp. below 60° on 5 days. TS on 27th, with ·24 in. of R in 8 minutes.

CROWBOROUGH.—A dripping June, changing the deficiency for the year into an excess of ·11 in. compared with the average of 34 years. The day and night temp. was high notwithstanding the R and N. and N.E. winds on 18 days, and there were many days of brilliant sunshine. TSS on 27th and 30th. Mean temp. 57°·9.

OSBORNE.—The R exceeded that of any June since 1860, when 5·38 in. fell.

HARTLEY WINTNEY.—A repetition of June, 1903. Cold and cheerless with R and wind storms till 18th, but afterwards a delightful spell of summer weather. Ozone on 19 days with a mean of 3·1. Hay crops very scanty.

ADDINGTON MANOR.—In a TS on 15th a large elm was struck by L.

RENDLESHAM HALL.—Heavy R to 10th, then nice showers to the end with hot sunny periods. Heavy TSS on 27th and 30th.

BURY ST. EDMUNDS.—The wettest June since 1860, when 4·40 in. of R fell. A very growing month. The old saying, "A dripping June brings everything in tune," came true this month, and the country was lovely.

BRUNDALL.—Heavy R at times and an unusual amount of T, some of the storms being severe and destructive. Mean temp. 59°·8, or 1°·4 above the average, and higher than in any June since 1897.

WINTERBOURNE STEEPLETON.—A dry month, following the previous shortage, made the deficiency for the year considerable. T on 14th and 16th.

TORQUAY.—Duration of sunshine 167·2* hours, or 64·0 hours below the average. Mean temp. 58°·4, or 0°·3 below the average. Mean amount of ozone 5·2; max. 8·0 on 5th with N.W. wind; min. 2·0 on 4th with E.S.E. wind.

HARTLAND ABBEY.—The district suffered much from the drought of May and the heat of June.

NORTH CADBURY.—A pleasant and beneficial June. The bountiful R from 5th to 12th saved the hay crop. There was a remarkable continuous cold R from 5th to 8th, like that of June, 1903.

CLIFTON.—Unsettled and rainy except from 22nd to 28th. Close and thundery with heavy R from 14th to 20th and on the last two days. R nearly 2 inches above the average, and the greatest in June since 1879, when 5·29 in. fell.

BOSTON.—The dry period and continuous N.E. winds ended on 17th with a heavy TS and 1·57 in. of R. Afterwards there were several partial TSS.

BOLTON.—Fine and bright. Mean temp. 57°·2, or 1°·2 above the average. Duration of sunshine 166·2* hours, or 5·4 hours above the average.

SOUTHPORT.—Chiefly characterized by prevalence of N.E. and E. winds, occasioning an abnormally dry atmosphere. Little cloud, much sunshine, and the largest mean daily range of temp. yet recorded. Mean temp. 1°·3 above the average. Duration of sunshine 33* hours above the average. R ·33 in. below the average. T and L on 18th and T on 19th. Several buildings struck by L on 18th.

LILBURN.—Again remarkable for small R and extreme heat. The total R for the first six months of the year was only 7·05 in., and the country suffered severely from drought.

LLANFRECHFA GRANGE.—R wanted early in the month, the ground being very dry and hard. Cereal and root crops backward. Meadow grass short.

HAVERFORDWEST.—A fine month; cool at first, but hot from 11th to the end. Crops generally good but late. Duration of sunshine 184·0* hours. No T88.

GOGERDDAN.—Very hot and trying. Good R in the third week came just in time to save the crops from failure.

SCOTLAND.

LANGHOLM.—R 1·01 in. below the average of 28 years.

TIGHNABRUAICH.—A delightful summer month, with very little R but heavy dews. Mean temp. 55°·3.

INVERARAY.—Remarkably dry, and the last ten days unusually warm.

MULL.—The driest June since 1895, when only ·77 in. of R fell. High temp. and heavy dews. Springs drying up and R much needed. No T.

COUPAR ANGUS.—The month may be divided into a cold and a warm period, the mean temp. before the 20th being 11° lower than that of the last eleven days. Mean temp. 56°·2. R about half the average.

ABERDEEN.—Fine, dry and warm, being the driest June since 1891, when the R was ·35 in.

LYNTURK.—Fine but exceedingly dry, the R being the lowest in any month in five years. There were T88 in the neighbourhood but none here.

DRUMNADROCHIT.—R 1·44 in., and rainy days 5, below the average of 19 years, the fall being the least in June in that period, except in 1889, when it was only ·33 in. There was much damage from extraordinary cloud-bursts in the vicinity. One of these took place on the higher course of this river, which rose so suddenly that several children were only saved with difficulty.

DUNROBIN CASTLE.—Dry easterly winds most of the month, crops on light soils suffering from drought.

ALTNAHARRA.—Intensely warm throughout, with exceptional continuance of sunshine and drought. Heavy local showers about the end.

IRELAND.

DARRYNANE ABBEY.—Fine and warm on the whole. R ·05 in. below the average of 25 years.

MILTOWN MALBAY.—Little R, cold dry winds and sunny days in the first half; the second half opened with three days of copious R, followed by a heat wave to the end.

DUBLIN.—A beautiful month, dry and bright, with a large preponderance of N.E. and E. winds. The only heavy R was on 16th, with T, and on 18th. Warm from 21st to 27th, the max. being above 70° each day. Duration of sunshine 237·5 hours. R since January 1st 1·86 in., and rainy days 3, below the average of 30 years.

BELFAST.—The R was almost an inch above the average, but of great benefit to the land. Excessive heat on 5 days.

OMAGH.—A remarkably fine and favourable month. A damp spell at the beginning was followed on 5th by 11 days without rain, fine and cloudless. Then 5 days of most welcome R, which gave place on 21st to 10 days of magnificent summer weather, the shade temp. reaching 80° on 23rd and 26th.

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* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, January, 1905.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	Inches		
London, Camden Square	54·3	6	21·2	16	43·5	32·7	33·9	88	69·9	18·1	1·34	8	8·6
Malta	60·4	17	38·7	4, 5	55·4	46·3	41·4	74	108·7	33·0	3·03	16	5·8
Lagos	...	...	...	...	...	...	...	...	...	...	...	...	—
Cape Town	98·1	16	53·3	2	77·7	61·1	60·5	73	...	...	·60	3	3·1
Durban, Natal	89·8	8	62·1	1	83·7	69·0	...	...	150·1	...	4·44	17	8·2
Johannesburg	81·2	13	51·5	19	75·3	53·8	54·6	75	146·0	49·2	3·25	17	5·0
Mauritius	88·5	21	71·0	12	84·6	74·1	73·7	85	156·4	67·4	21·09	31	8·4
Calcutta	83·7	29	47·8	27	75·8	55·4	55·7	71	136·4	42·2	·94	2	2·1
Bombay	86·9	8	56·1	31	80·9	66·6	62·0	69	137·8	48·3	·00	0	1·7
Madras	87·2	24	57·4	29	83·2	65·2	64·6	75	140·8	52·8	1·92	3	2·3
Kodaikanal	67·4	30*a*	39·8	29	61·3	44·9	43·3	75	121·4	23·2	·56	5	3·9
Colombo, Ceylon	91·2	27	67·2	14	86·8	72·2	70·4	78	150·7	61·5	4·05	7	2·3
Hongkong	79·3	23	46·8	31	69·0	60·7	58·4	79	131·1	...	1·80	4	6·2
Melbourne	108·5	11*b*	45·6	24	81·2	57·3	52·7	60	165·4	36·0	1·47	9	4·8
Adelaide	109·7	12	51·3	31	87·4	62·3	52·0	44	164·0	43·1	1·31	6	4·9
Coolgardie	108·5	20	47·2	2	94·0	61·8	54·5	45	175·0	41·2	·46	3	1·3
Sydney	87·5	2	55·6	24	79·1	66·0	62·2	68	128·9	45·4	1·74	10	3·9
Wellington	75·6	17	41·9	2	64·8	52·6	50·2	74	139·0	37·0	2·12	11	7·3
Auckland	78·5	19	48·0	3	67·6	55·4	51·9	71	140·0	38·0	2·79	12	6·8
Jamaica, Negril Point	88·0	31	62·9	27	83·0	69·4	68.3	78	...	...	·81	4	—
Grenada	86·4	27	69·0	28*c*	81·9	71·9	68·5	71	149·2	...	2·92	15	5·1
Toronto	42·2	1	-7·1	26	25·3	10·4	15·8	84	49·8	—10·0	3·28	18	7·1
Fredericton	43·9	1	-33·5	15	22·9	-3·4	—6·0	60	...	...	6·62	12	6·4
Winnipeg	29·5	18	-39·1	10	5·7	-16·0	...	...	...	...	·20	3	3·1
Victoria, B.C.	55·0	24	27·4	13	44·6	37·4	...	...	...	...	3·34	18	7·9
Dawson	..	...	...	...	...	...	...	...	...	...	...	...	—

a—and 31. *b*—and 13. *c*—and 29.

MALTA.—Mean temp. of air 50°·6, or 2°·7 below average, mean hourly velocity of wind 12·4 miles, or 1·2 above average. Mean temp. of sea 56°·0. L on 8th. F on 3rd, 4th, and 28th.

Mauritius.—Mean temp. of air 0°·2 below, dew point 3°·6, and R 11·78 in., above averages. Mean hourly velocity of wind 8·0 miles, or 3·1 miles below average.

MADRAS.—On the 29th the min. temp. was 57°·4, the lowest ever recorded, except 57°·3 in 1895. Bright sunshine 228·9 hours.

KODAIKANAL.—Bright sunshine 205 hours.

COLOMBO.—Mean temp. of air 79°·2, or 0°·1 above, of dew point 0°·4 above, and R ·49 in. above, averages. Mean hourly velocity of wind 7·8 miles; prevailing direction N.W. and N.

HONGKONG.—Mean temp. of air 64°·3. Bright sunshine 142·9 hours. Mean hourly velocity of wind 11·5 miles; mean direction E. 11° S.

Adelaide.—Mean temp. of air 0°·8 above, and R ·60 in. above 45 years' average.

Sydney.—Mean temp. of air 1°·1 above, R 1·79 in. below, and humidity 2·6 below averages.

Wellington.—Mean temp. of air 4°·1 below, and R 1·42 in. below, averages.

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ON THE AMOUNT OF HEAT REQUIRED FOR THE GROWTH AND RIPENING OF WHEAT.

By R. H. Curtis.

The relation of Meteorology to Agriculture is a large subject which may be studied from several points of view. In some of its aspects the relation is sufficiently obvious, but in others it requires to be sought for, and, as has happened in other fields of enquiry, it may perhaps be found in unlooked-for directions and as the result of indirect research. The connection between the rainfall of autumn and the yield of wheat in the ensuing harvest, to which Dr. Shaw has recently called attention, would appear to be an example of such an unexpected discovery, and doubtless there are others equally interesting awaiting the patient investigator in this promising branch of enquiry.

Many facts have been observed in connection with the growth of plants which lead to the probable conclusion that the amount of heat required to enable them to perform the several functions involved must be the same for the same plant when grown under fairly similar conditions; and if these thermal constants could be determined they would probably be of considerable value. As to the precise part which heat plays in connection with growth, very little is known with certainty. Whether it is used, and if so to what extent, in the transformation of the materials of which a plant is built up; or in keeping alive and in action certain of its organs; or whether the plant itself develops heat, some of which it may possibly use again, are questions upon which we have little definite knowledge, and they lie perhaps beyond the province of meteorology. But it is within its province to ascertain information relating to the meteorological conditions which influence plant life, and these certainly embrace the amounts of heat required to bring about the accomplishment of certain stages of growth, such as the ripening of cereal crops, a knowledge of which would be of no small theoretical and practical value.

This is a subject which has already received a considerable amount of attention, and, amongst others, Boussingault, Hervé-Mangon, and De Candolle on the Continent, and Dr. Gilbert, F.R.S., in this

country, have endeavoured to determine the thermal constants for various plants, but especially for the ripening of wheat.

The method usually followed on the Continent was to find the mean temperature of the air for the entire period covered by the growth of the plant, and then to multiply the excess of that figure above zero centigrade by the number of days in the period, and to regard the product as the accumulated amount of temperature required. Gilbert somewhat modified this by starting his period from arbitrarily chosen dates, as the 1st of January, the 1st of February, &c., and also from the time at which the temperature had so far advanced in its annual march that it continuously showed some excess over the point selected as his zero. This point was 42°, Fahr., which was regarded as the critical temperature at which the processes involved in the growth of the plant became active, whilst they remained dormant when the thermometer fell below it. Of course it is quite possible that each species may have, to a certain extent, its own zero at which growth begins, but probably the value chosen by Dr. Gilbert is very nearly correct for most, or at any rate for the cereals generally grown in this country.

The temperature observations employed by Gilbert were the monthly means for Greenwich for the years 1852-78, and the daily means for the six years 1871-76. He also used the mean values for accumulated temperature published by the Meteorological Office for the Eastern and Midland Counties of England for the years 1878-85; the termination of his period was in every case the time at which the harvest was reaped at the experimental agricultural station at Rothamsted.

It may be well to explain here that the values of accumulated temperature which have been published by the Meteorological Office since the year 1878, and which are the values referred to above as having been to some extent used by Dr. Gilbert, are calculated by a method devised by Gen. Strachey, F.R.S., for finding from ordinary temperature observations the amounts of the daily temperature above and below a fixed base such as Dr. Gilbert used. The results are expressed in what are termed *day-degrees*, following the analogy of the *foot-pound*, the term signifying a degree of temperature continued throughout the whole day. Thus, if the temperature throughout the day was continuously 44°, the base temperature being 42°, the accumulated temperature for the day would be 2 day-degrees. If, again, the thermometer should read 40° from midnight to noon, and then suddenly rising should remain at 44° till the following midnight, it would be equivalent to 1 day-degree *below* the base and 1 day-degree *above*, the two degrees for the half-day being obviously the equivalent of one degree for the whole day. General Strachey has given a formula for calculating these values from the readings of the maximum and minimum thermometers, and also for obtaining the mean temperature more accurately than by simply taking the mean of the readings of the two instruments as is usually done.

To turn now to Dr. Gilbert's results. As might have been expected, he got a somewhat smaller sum of accumulated temperature according as he moved the starting point of his calculations further into the year, and the results were also different, as they were derived from the Greenwich monthly means, the Greenwich daily means, or from the accumulated mean temperature values for the Eastern and Midland Counties published by the Meteorological Office. Starting in each case from the 1st of January, the average amount of accumulated temperature to the time of wheat harvest from the three sets of data was 2023° F., 2189° F., and 1904° F., respectively. Boussingault's values are much larger than these, even when reduced to the same base temperature, but this may have been due to his having used an average term for the growth of the wheat, instead of the more precise Rothamsted data employed by Gilbert. Hervé-Mangon found the value for wheat to be 1854° F. when corrected to 42° as the base value, and this amount approximates very closely to that Gilbert obtained from the Meteorological Office data.

The result of some calculations of the amount of accumulated temperature required for the blossoming of a plum tree, which I made some time ago, led me to the conclusion that it was not right to select an arbitrary date for commencing such calculations, but that they ought to cover the whole interval between sowing and reaping. Nor, for that matter, is it absolutely certain that the base temperature selected is the most suitable, or that it should be maintained throughout the whole of the year, for it is quite possible that growth may go on with lower temperatures than 42° F., or that, at any rate, with such lower temperatures certain changes and modifications proceed in the plant which prepare it for more active development later on.

It was with a view to testing some of these conclusions that I obtained, through the kindness of Mr. A. D. Hall, M.A., the Director of the Lawes Agricultural Trust, the dates of sowing and reaping wheat and barley crops at Rothamsted over a long series of years, the whole of which I have, unfortunately, not been able to use owing to the absence of the corresponding temperature observations.

For the purpose of my calculations, I employed the temperature observations actually made at Rothamsted, instead of using a mean value for a large district which might possibly embrace at once very dissimilar conditions of weather; and I also got out the number of day-degrees below, as well as above, 42° F. from the time of sowing till harvest.

The mean amount of accumulated temperature, above 42°, required for the growth and ripening of autumn sown wheat is shown by my calculations to be 1961 degrees Fahrenheit; the maximum amount is 7 per cent. in excess of this figure, and the minimum, which comes from the data for last year, 1903-4, is 8 per cent. below it. But whilst the time interval between sowing and ripening varies in different years by as much as seven weeks, which is 17 per cent. of the average period, the differences in the amounts of accumulated tempera-

ture are within 2 per cent. of the average in 16 out of the 28 years dealt with. In eight of the remaining years it amounts to or exceeds 5 per cent.; so that, speaking broadly, one may say that the divergencies from the average, when not trifling, are rather large. This, I believe to be due to the modifying effect of other important elements, such as rainfall or sunshine, which have to be considered in conjunction with temperature, and whose incidence separately or combined was more or less abnormal in those years. The year, 1903-4, in which the largest difference from the mean temperature occurs, the 8 per cent. just mentioned, affords an illustration of this. That year was abnormal in respect of the short interval which elapsed between sowing and harvest, and also in the *distribution* of rainfall over the period. I find that for the 38 weeks it covers (strictly, 262 days), the total rainfall was nearly normal in amount, but that during no fewer than 28 weeks of the period it was less than normal, to an aggregate amount of nearly 8½ inches. This deficit was made up to the extent of 8 inches in 10 weeks of excess, six of which fell within the winter limits when the temperature was low and growth almost stationary. Mr. Hall, the Director at Rothamsted, referring to the effect of moisture on growth in a letter to me, says: "Great dryness shuts up the growth of the plant and leads to premature ripening, the farmer is well acquainted with the character of such grain," and he gave me details of experiments he has made on the subject, in one of which three pots of wheat were grown under similar conditions of heat, whilst the supply of water was throughout maintained in one pot below, in another at, and in the third above the optimum, with the result that the low water ripened a week or ten days before either of the other two. A similar deficiency of water must, I think, have been the cause to which the abnormally short period between sowing and harvest and the consequently small amount of accumulated temperature in this year was due, and probably, also, the other fact that the yield of wheat for the year was exceptionally small.

The space at my disposal in this Magazine will not allow me to go at greater length into the influence of rainfall, or even to touch upon that of sunshine, both of which elements are, of course, intimately connected with the effect of temperature upon growth; nor can I refer at this time to the temperature results I have similarly obtained for the growth of barley.

"BRITISH RAINFALL, 1904."

THE volume of *British Rainfall* for 1904* was published on August 11th. It is exactly the same size as last year; the reduction in the number of pages in Part II., due to the less remarkable rainfall

* On the Distribution of Rain over the British Isles during the year 1904, as observed at about 4000 stations in Great Britain and Ireland. With articles upon various branches of Rainfall Work. Compiled by Hugh Robert Mill. London: Edward Stanford, 1905.

of 1904, being equalised by the increase in Part I. on account of the greater space devoted to original articles on rainfall work, and to the introduction of a new feature, the publication of complete daily records for ten selected stations.

The increase in the number of stations is less than in 1903, but amounts to the very substantial number of 153, the total number of records dealt with being 3982. All the new features introduced last year have been continued, and special attention has been devoted to the mapping of heavy rains. Nine of the wettest days have been selected for complete cartographical treatment, the distribution of rainfall being brought out by lines drawn for ·25 in., ·50 in. and for each whole inch of fall. The tracks of the atmospheric depressions associated with the day's rain are added.

The special articles in Part I. include a brief analysis of the rainfall records at Ben Nevis and Fort William, illustrated by a striking photograph of the high-level Observatory. There is also a discussion of Dry Octobers in which the four driest Octobers since *British Rainfall* was instituted are compared, and October, 1904, shown to have been the driest with one exception in that period. The most important article is devoted to the Mean Monthly Duration and Rate of Rainfall at Camden Square, based on the measurement of the traces of an automatic recording rain gauge for twenty-four years. Although this paper is only preliminary to a complete discussion, it yields some interesting results of a definite nature. One of these is that although the curve of mean monthly rainfall and the curve of mean monthly duration show double maxima and minima in the year, the curve of mean monthly intensity of rainfall which results from them shows a single maximum in July and a single minimum in January with a remarkably uniform rise and fall. It is shown that the rate of fall of rain per hour is twice as great in July as in January, and the annual curve of intensity bears a considerable resemblance to the annual curve of mean temperature of the air.

The Editor points out that the distinctive feature of *British Rainfall* is the joint responsibility of the Observer and the Editor for the accuracy of every entry, and he mentions that one return in every eight has been the object of special editorial enquiry before its value was accepted as correct.

SCOTTISH METEOROLOGICAL SOCIETY.

At the half-yearly meeting of this Society held in Edinburgh on July 18th, the following Report was presented by the Council:—

There has been no change in the Society's stations since the meeting in March.

The Registrar-General for Scotland has been regularly supplied with the monthly and quarterly reports from this office; and also direct from the observers in the eight large towns of Scotland, with

the daily observations of temperature and rainfall required for his weekly reports.

The Meteorological Council at London has been supplied direct from the observers at Glencarron, Fort Augustus, Braemar, Clathick, Marchmont, and Cally, with daily observations of temperature and rainfall, and in some cases sunshine, for their weekly weather reports.

As stated in the Report to the meeting in March last, the Ben Nevis and Fort William Observatories were closed in October, 1904. The buildings on Ben Nevis, and the bridle-path which extends from the foot of the hill to the summit, have now been handed over to the proprietor of the ground, in accordance with the stipulation in the Feu-charter, by which, when the building ceased to be used as an Observatory, the ground and all buildings on it revert to the Superior. The Observatory in Fort William has been advertised for sale, but has not yet found a purchaser. As soon as the Fort William Observatory is sold, the Observatories' Fund will be wound up and the board of directors dissolved.

The closing of the Ben Nevis Observatories and the dissolution of the board of directors can only be regarded as a great blow to meteorological investigation in Scotland. The important work of discussing and utilising the Ben Nevis records will now devolve on this Society. The Society has no funds available for this purpose, but certain charges in connection with the examination and discussion of the Ben Nevis observations, which were formerly paid by the Ben Nevis Observatories' Fund, have, since 31st December last, been borne by the Society. During these six months the Society has received special donations from gentlemen interested in the continuance of the discussion of the Ben Nevis records, which have enabled it to meet this additional outlay. Intimation has also been received that for the ensuing academic year 1905-6 a sum of £100 will be granted for this object to Dr. Buchan by the Carnegie Trust for the Endowment of Post-graduate Research. But more will be needed if the Ben Nevis record is to be fully utilised.

The third volume of the Ben Nevis observations, containing the records for the years 1893 to 1897 inclusive, is approaching completion.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE STUDY OF THUNDERSTORMS.

THUNDERSTORMS in England derive a special interest both on account of their comparative rarity and their uncertainty as to time and place of occurrence. It has often occurred to me, therefore, that this much neglected branch of British climatology might be cultivated more assiduously than it is with the object of ascertaining

the periods and areas of maximum and minimum frequency of storms, and then, with the aid of the known laws of physics, of theorizing upon and establishing, as far as possible, a science of British thunderstorms.

If readers of this Magazine in all parts of the British Islands would care to co-operate with us for the purpose, and send us in notices of all thunderstorms that occur in their respective localities, we would record and tabulate these notices, and after the accumulation of a sufficient number of facts, discuss them, with the hope of of investigating into the real nature and causes of thunderstorms. In the notices received information would be useful as to (1) the type of thunderstorm experienced; (2) the intensity and duration of the storm, amount of rainfall, occurrence of hail, &c.; (3) the conditions of temperature and humidity before, during and after the storm; (4) damage caused by the storm; (5) the geographical features of the locality reporting the storm, while the distribution of atmospheric pressure over Great Britain during the stormy periods would also be studied. Obviously the reports would have to be received from fixed stations and not from observers away from home; also, since no two observers would agree as to what constitutes a thunderstorm, let us fix an arbitrary standard and define a thundery day as one upon which thunder is heard at the place of observation, just as a "rainy day" is one with ·01 in. of rain.

I have a very strong suspicion that one of the areas of maximum frequency and intensity of summer thunderstorms in England will be found to lie among the Pennine moorlands, for my own experience of thunderstorms in East Lancashire and the West Riding of Yorkshire has led me to believe that they are more persistent and severe in those districts than in the neighbourhood of London even, where storms are undoubtedly relatively frequent; and I believe it is a fact that the Stonyhurst Observatory on the border of north-east Lancashire records on an average more thunderstorms a year than the Greenwich Observatory. It would be interesting to compare the observations of storms in the Pennine district and in the Lake country with those of storms in upland tracts in the south of England like Dartmoor, Exmoor, or Hindhead.

Most people have an instinctive idea that thunderstorms are less frequent at the seaside than inland, but the reason for the fact that they are is not altogether so obvious as it is sometimes imagined. So far as I know, little exact knowledge exists relating to the distribution of British thunderstorms, and on that account I have considered it not inappropriate to make the above proposal to readers of the Magazine.

Perhaps when we know more about our own displays of thunder and lightning, we shall feel more disposed to compare them with the grander and more terrible electrical phenomena of central Europe, notably those of France and northern Italy.

L. C. W. BONACINA.

4, York Terrace, Sidmouth, Devon, July 26th, 1905.

[We should be pleased to assist in any well-devised scheme for the study of thunderstorms. Perhaps Mr. Bonacina might be disposed before launching a new scheme to prepare a summary of the results obtained through Mr. Symons's investigations commenced in 1858, and those of the Thunderstorm Committee of the Royal Meteorological Society which reported in 1888 and 1889. This would greatly facilitate fresh efforts.—ED. *S.M.M.*]

THE PARALLEL BETWEEN 1896 AND 1905.

I CORDIALLY endorse your criticisms in the June number (page 85) upon the comparison which I have been attempting. It is entirely true that one heavy rain, whether at the beginning or end of a month, may entirely change its character, and make that which truly was a parallel appear from the tables to be no parallel. But the converse does not hold; the month cannot appear to have been dry throughout without having been so in reality.

To compare the Junes of 1896 and 1905 by the light of the tables already published, it is clear that the parallel can be claimed for no more than the southern half of England and Wales, though in some parts of that area it was very close.

It remains to be seen how far the July now ended will have been, as in 1896, very warm and dry over England south of the Humber and in South Wales, and, on the contrary, wet and cool in Scotland and excessively wet in Ireland.

The tables for 1896 show that August had its first three weeks dry, but conspicuously deficient in warmth, and turned wet at the close; and that September was excessively wet over all our islands, every station but one having a +, and these excesses in almost every case very large ones indeed.

Few of your readers can have stronger reasons than myself for hoping that the period August 20th to September 30th may depart as *widely as possible* from the 1896 pattern. I do not at all desire to be "a true prophet once more." H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, Somerset, August 1st, 1905.

RAINFALL AT SUNDERLAND.

MY record is so extraordinary for the seven months that I enclose my monthly values up to date:—

1905.	Total. in.	Max. Fall. in.	Date.	Days.
January	·27	·10	17	7
February	·56	·19	13	12
March	1·60	·45	26	14
April	2·53	·37	23	21
May	·78	·31	3	9
June	·79	·32	18	6
July	·98	·33	23	8
	7·51			77

Perhaps the most striking thing is the fact that the total for the three months, May, June and July, only gives 2·55 in. The month of July has been very hot, causing the summer drought to be most trying.

Reviewing the twelve months from the date of this letter, I may remark that only 16·61 in. has fallen, during which period there have been seven months giving each less than one inch.

W. F. VINT.

The Cedars, Sunderland, August 1st, 1905.

LIGHTNING CONDUCTORS.

A FEW years ago a theory was brought forward that there is no necessity to place a lightning conductor on an *old* church; because if the church has never been struck by lightning, the probability is that it never will be struck.*

This proposition seems at first sight very plausible. For if a church tower or spire, erected in the fourteenth or fifteenth century, has remained until the twentieth century without a lightning conductor, and without having attracted the lightning, it is probable that there is some especial reason for its immunity. The causes which conduce to this freedom from injury are not always easy to trace. It may be that there is some conformation of the land which draws the thunderstorms away from the church; or there may be some hills or high trees in the immediate neighbourhood; or possibly a bed of ironstone, which absorbs the lightning. In any case, by the laws of chance, if a high building has existed for five hundred years without damage by lightning, it is probable that it will stand for all time without being struck.

This protection, whatever it may be, is however liable at any time to fail, and a violent and erratic flash may in an instant destroy a beautiful piece of architecture which has stood for centuries.

A remarkable example of this occurred in Egypt on the 31st March last, when, during a very violent thunderstorm, "the minor pyramid of Ghizeh was struck by lightning slightly below the apex of the monument. Several of the immense stone boulders of which the pyramid is built were dislodged, and rolled down with a terrific crash on to the sands below. The place that received the shock looks like a gaping wound. No such accident has occurred within living memory."†

This pyramid was erected by King Menkaoora about the year 3633 B.C.; and, as far as we know, it has stood since that time without being struck by lightning. We cannot, therefore, avoid the conclusion that a building without a lightning conductor is never safe from the lightning flash; no, not after a period of five thousand years.

CHRISTOPHER A. MARKHAM.

The Garth, Dallington Avenue, Northampton, 8th July, 1905.

*, *Symons's Monthly Meteorological Magazine*, June, 1898, p. 65.
† *The Times*, 10th April, 1905.

REVIEWS.

Transvaal Meteorological Department. Observations for the period 1st July, 1903—30th June, 1904. With Appendix. First Report. Pretoria, 1905. Size 13 × 8½. Pp. 68.

We welcome Mr. Innes's first Report of the Transvaal Meteorological Service, though at first sight it seems a trifle confusing to include parts of two calendar years. It is explained, however, that it is in harmony with usage in the northern hemisphere to break the year in winter. This strikes us as a bad reason, because it is not on account of the seasons but of the calendar that it was ever adopted. Further, it is pointed out that the summer is the rainy season, and therefore it is an advantage to keep the summer unbroken. This seems to us a good and sufficient reason for the method adopted. We note with pleasure that the time-reckoning is from 0 to 24, thus obviating the stupid and bewildering use of *a.m.* and *p.m.* to which we have grown accustomed.

So far as a hasty glance at the list of stations allows us to estimate, the number at work in the colony is 210. Most of these are rainfall stations, now using a 5 in. Snowdon gauge with the rim set at a height of 4 feet above the ground, though many are still equipped with a shallower funnel, which leads to much loss by out-splashing in hail or heavy rain. In the tables of rainfall we note that cyphers are inserted for falls less than an inch. Experience will, we believe, show that the practice always followed in this Magazine and in *British Rainfall* of omitting the cypher before the decimal point saves much trouble and many errors.

We write this note hurriedly, not because the Report is of small interest, but because it is our last bit of editorial work before we start to see for ourselves something of the equipment of the South African meteorological services.

London Fogs. Report of the Meteorological Council upon an Inquiry during the Winters of 1901-2 and 1902-3. London, 1904. Size 12 × 10. Pp. 48. *Plates.* Price 2s. 6d.

It can hardly be denied that all that could be done with the time and materials at disposal, was done in the investigation of London fogs, recently undertaken by the Meteorological Council. Unfortunately, however, the means available were of so scanty a nature that the chief aim of the inquiry, the satisfactory forecasting of fogs and of their probable density and duration, must still be largely a problem of the future.

When the winter of 1901-2 was already so far advanced as to render a study of the season as a whole impossible, a grant of £250 by the London County Council, enabled the Meteorological Council to appoint Captain A. Carpenter to conduct the inquiry. With the co-operation of the Metropolitan Fire Brigade, the Metropolitan

Police, the Superintendents of the London Parks and various official and private observers, Captain Carpenter collected all the available information, and his ultimate conclusions may be briefly stated as follows :—

(*a*). There is no evidence of special connection between fog and geological conditions.

(*b*). Elevated stations are freer from fog than others.

(*c*). Fogs are produced in London by local conditions, and are not identified with any particular locality in London. The local atmospheric conditions need further investigation.

(*d*). The meteorological conditions for the formation of fog are carefully set forth and illustrated. They include barometric pressure, air temperature and river temperature. In 22 cases out of 25 during the night preceding fog the temperature of radiation fell much below the river temperature.

(*e*). There is a marked tendency for fogs to commence in the early morning after a clear night.

The question of the possibility of foretelling fogs, apart from the more definite conclusions arrived at as to favourable conditions, was not materially advanced, but a more extensive observational investigation was urged, and notes upon the outstanding part of the inquiry were set forth. To this end, in spite of the inability to obtain further support from the London County Council, the Meteorological Council carried on the collection and discussion of the observations during the winter of 1902-3, and Mr. R. G. K. Lempfert made a report upon the work. The comparative absence of fog in that season somewhat hampered the inquiry, but the observations were commenced on September 1st, and all cases of autumnal fogs were included. An improved classification of fogs with regard to density, based on their relative interference with traffic, was introduced with very fair success, and Dr. Shaw's distinction between "steaming-water fogs," "cold-surface fogs" and "cloud fogs" rendered the discussion more complete.

It is considered possible that a special organization, capable of putting the requisite meteorological observations in the hands of an expert at 5 a.m., would make it possible to forecast local fogs with some degree of success, but it is again urged that a further examination of the meteorological conditions is previously required.

Included in the report are many plates and maps showing the distribution of typical fogs, and the observations of temperature, etc., taken at the time.

SEVEN MONTHS' RAINFALL OF 1905.

Aggregate of Rainfall for January—July, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	13·41	102	Bolton	19·34	93	Braemar	16·70	94
Tenterden	14·95	108	Wetherby.....	10·53	74	Aberdeen	13·61	81
Hartley Wintney	13·36	96	Arncliffe	25·11	80	Cawdor	16·22	106
Hitchin	13·32	104	Hull	10·66	78	Invergarry ...	32·18	113
Winslow	11·45	81	Newcastle.....	8·94	63	Bendamph ...	44·44	105
Westley.....	13·29	100	Seathwaite ...	61·96	93	Dunrobin	17·00	104
Brundall	11·43	89	Cardiff, Ely ...	17·46	84	Killarney ...	24·63	82
Alderbury	15·33	103	Haverfordwest	20·83	89	Waterford ...	19·12	94
Winterbourne ...	14·03	73	Gogerddan ...	22·52	103	Broadford.. ...	17·29	101
Torquay	14·16	80	Llandudno ...	13·58	92	Carlow	14·78	82
Polapit Tamar ...	15·91	87	Cargen	19·41	88	Dublin	11·03	76
Bath	11·69	74	Lilliesleaf	12·99	76	Mullingar.....	16·08	85
Stroud, Upfield...	14·26	91	Colmonell	18·16	82	Ballinasloe ...	14·20	74
Woolstaston	14·70	87	Glasgow	14·60	80	Clifden	33·08	82
Bromsgrove	10·20	79	Inveraray	36·00	116	Crossmolina ...	23·10	91
Boston	11·38	93	Islay, Eallabus	25·23	111	Seaforde	15·31	75
Hodsock Priory..	9·11	68	Mull	28·78	102	Londonderry..	19·16	93
Derby.....	8·97	64	Dundee	10·10	67	Omagh	19·44	101

The column of the rainfall table for July devoted to difference from the average exhibits an unbroken succession of minus signs, denoting that the fall for this month fell short of the average over the whole of the British Isles. It is probable, however, that in localities where the thunderstorm of the 9th reached its greatest intensity, instances of excesses occurred. The result of the general deficiency was to reduce the average of the percentages in the aggregate table from 97 for January to June to 89 for January to July. Only a comparatively small portion of the British Isles has an aggregate fall still in excess of the average; this portion comprises the whole of that part of Scotland lying to the N.W. of a line drawn from Kintyre, through the Trossach district and roughly along the course of the river Spey. Inveraray was comparatively the wettest spot, with 116 per cent. An area in the S.E. of England, just including London and extending N. to Bury St. Edmunds and W. to Salisbury, also had a fall exceeding the average to a slight extent, and almost negligible isolated excesses occurred at Aberystwyth and Broadford. A considerable area over which less than three-quarters of the average fall has taken place lies in the S.E. of Scotland and N.E. of England, extending from Forfarshire along the E. coast and into the English Midlands. We print elsewhere a letter calling attention to the abnormally deficient rainfall at Sunderland, to which the nearest station included in the table is Newcastle, with only 63 per cent. of the average. In the extreme N. and S. of this area Dundee had only 67 per cent. and Derby 63 per cent. There was also a small area in Dorset with a deficiency exceeding a quarter of the average. Ireland showed a fairly uniform deficiency, reaching 26 per cent. at Ballinasloe.

METEOROLOGICAL NEWS AND NOTES.

THE BRITISH ASSOCIATION meets this year in South Africa, and our report of the proceedings as regards meteorology must consequently appear a little later than usual. The scientific meetings of the Association were planned to commence at Cape Town on August 15th, and after a few days they will be adjourned to Johannesburg, where the official party arrives on the 28th. On the conclusion of the scientific meetings a long excursion will be made by special train, extending as far as the Victoria Falls on the Zambesi, and a large party will return to England from Beira in Portuguese East Africa, calling at various points on the east coast on the way homeward through the Red Sea and Suez Canal. We understand that although the papers dealing with meteorology are, this year, to be scattered through several sections, the usual opportunity of a reunion of meteorologists and rainfall observers will be afforded by a Meteorological Breakfast in Cape Town.

THERE ARE DEGREES OF MANY KINDS adapted for measuring different phenomena, but while some degrees are convertible into distances, others are not. The observer, from whose report of a double rainbow in a provincial paper (the editor's blushes we sympathetically spare by suppressing name and date) we quote the following trifle, came near to finding the pot of gold that tradition says lies buried under the rainbow's foot :—"To give an idea of the width of the band from the inner violet to the outer violet is exceedingly difficult; but where the horizon was near to the observer, the band of the double bow would be about eighty yards wide." We wonder how wide the moon appears on the same scale.

THE TRUE DIRECTION AND VELOCITY OF THE WIND AT SEA may be determined by means of an instrument devised by Mr. A. Lawrence Rotch and manufactured by Mr. Casella of Holborn. This instrument, which consists of two brass discs marked with the points of the compass, and pivotted with three graduated rules, performs the operation of combining the direction taken by the smoke, or pennant, of a ship with the course and speed of the vessel, in such a manner that the resultant direction and velocity of the wind can be read off without further calculation. Mr. Rotch has found the instrument specially useful for determining wind when flying kites from vessels, and it has been satisfactorily tested during four transatlantic voyages.

AN EXTREMELY HEAVY FALL OF RAIN in one day is reported in the *Cincinnati Price Current* (Ohio) of June 29th, 1905 :—"Two weeks before, at Birmingham, in S.E. Iowa, 10¾ in. of rain fell in twelve hours according to 'Government measurement'; and at Milton, a little further south, a correspondent reported 12 in. of rain as having fallen in eight hours."

RAINFALL IN THE TALLA VALLEY.*

At the beginning of 1896 the Edinburgh Water Trust undertook to ascertain the mean rainfall of the Talla Drainage Area, in the south-east of Peeblesshire, with a view to adjusting the compensation due on impounding the stream for the water-supply of Edinburgh City. For this purpose seven rain gauges were erected at spots within the area in question, varying in altitude from 966 feet to 2627 feet, and so placed that their readings should give a proper representation of the rainfall. The observations were subsequently tabulated and discussed by Mr. Hall Blyth and Mr. W. A. Tait, and the results laid before the Royal Society of Edinburgh.

It was found necessary to augment the arithmetical averages of the total falls for the seven years over which observations extended by 4 per cent, in order to arrive at an approximately correct value for a long period. This process showed means varying from 47·66 in. at Quarter Hill in the extreme north of the area, 1196 feet above sea level, to 73·92 in. at Gameshope Farm at 1538 feet. The mean of the seven gauges was 62·51 in., or for a long period 65 inches. The increase of rainfall with altitude was somewhat irregular, since three stations gave values exceeding that of the most elevated station, and two had considerably less rainfall than the least elevated.

From a table giving the average results for the seven gauges for each month it appears that December was by far the wettest month, having a mean fall of 8·76 in., whilst November, the next wettest, had only 6·44 in. May was the driest with 3·37 in. It is obvious that the period is far too short for the monthly means to have much significance, but it is noticeable that the total for the six months July to December exceeded that for January to June by 11·63 in. The wettest month recorded was December, 1900, with 17·11 in. at Gameshope Farm, and the driest, March, 1900, with ·30 in. at Gameshope Loch.

Daily records were maintained at three duplicate gauges, and these showed that the longest period of practically continuous rainfall was from September 11th to October 11th, 1896, during which period 13·89 in. of rain fell at Gameshope Farm; and the heaviest continuous fall was from December 26th to 30th, 1897, when 9·99 in. fell at the same station. Three falls exceeding 3·00 in. in 24 hours took place at Gameshope Farm, none at any other station.

It is gratifying to know that, upon the recommendation of the Arbiters, the Edinburgh Water Trust have agreed to continue the gaugings, recognising that the ultimate value of so unique a series of observations cannot fail to be very great.

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* Note on the Rainfall on the Drainage Area of the Talla Reservoir, by B. Hall Blyth and W. A. Tait. *Proc. Roy. Soc. Edin.*, XXV. (1905), 616–629.

OPTICAL CONVENTION, 1905.

THE Optical Convention was held at the Northampton Institute, Clerkenwell, E.C., from May 31st to June 3rd. The object of the convention was to bring into close sympathy and co-operation men who are interested in optical matters from all sides of the question, technical and scientific.

Dr. R. T. Glazebrook, F.R.S., Director of the National Physical Laboratory, was the President, and he delivered the opening address at a Conversazione on Tuesday evening, May 30th. The mornings of the subsequent days of the week were devoted to papers and discussions on optical subjects. On Thursday evening, Prof. Silvanus P. Thompson, F.R.S., delivered a lecture on "The Polarization of Light by Nicol Prisms and their modern equivalents;" and on Saturday afternoon the members of the convention went on an excursion to Teddington to inspect the National Physical Laboratory.

In connection with the Convention an exhibition of Optical and Scientific Instruments was held in the great hall of the Northampton Institute, the stands being arranged on the ground floor and in the gallery. Optical glass was shown in its crude state, and the various processes could be traced through which it has to pass until it becomes a lens for the spectacle or an object glass for the most powerful telescope.

The catalogue, which was a special feature of the exhibition, was compiled in order to be a work of permanent value. It contained a classified description not only of the objects exhibited, but of the other work of many representative firms, arranged in such a way that anyone consulting it can easily find by whom the goods he is in search of are made, and where he is to go to see specimens or to obtain information.

Class VII. was devoted to "Meteorological Instruments and Temperature Measurers." The instruments were grouped in the catalogue under the following sections, although the various instruments were placed on the individual makers' stands—viz: 1. Barometers; 2. Self-Recording Barometers; 3. Thermometers; 4. Self-Recording Thermometers; 5. Hygrometers; 6. Anemometers; 7. Sunshine Recorders; 8. Rain Gauges; 9. Evaporimeters; 10. Miscellaneous; and 11. Atmospheric Electricity.

The exhibitors in this class were: Anglo-American Opitical Co., Messrs. R. and J. Beck, Cambridge Scientific Instrument Co., Messrs. J. Casartelli and Son, Messrs. F. Darton and Co., Messrs. J. Davis and Son, Messrs. Dring and Fage, Mr. F. L. Halliwell, Mr. J. J. Hicks, Mr. G. Kent, Messrs. Lander and Smith, Messrs. Negretti and Zambra, and Messrs. Short and Mason.

As the exhibits were confined to the work of English makers, the well-known instruments of MM. Richard Frères and other foreign firms were not included in the exhibition.

RAINFALL AND TEMPERATURE, JULY, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.
		inches	inches.	in.						
I.	London (Camden Square) ...	·96	— 1·53	·31	9	8	85·3	26	49·8	7
II.	Tenterden	·59	— 1·67	·36	4	6	83·0	14	49·0	20
,,	Hartley Wintney	·94	— 1·44	·48	5	5	83·0	9, 26	48·0	19
III.	Hitchin	1·25	— 1·30	·66	9	8	80·0	8, 9*a*	46·0	6, 18
,,	Winslow (Addington)	1·22	— 1·55	·54	1, 9	6	82·0	14, 26	44·0	7, 19
IV.	Bury St. Edmunds (Westley)	1·15	— 1·76	·49	27	8	85·3	14	46·0	7
,,	Brundall	·65	— 2·05	·19	15	6	82·6	14	48·8	7
V.	Alderbury	·30	— 2·16	·10	22	7	88·0	21	32·0	6
,,	Winterbourne Steepleton ...	·50	— 2·28	·38	10	4	78·9	25	39·8	7
,,	Torquay (Cary Green)	·59	— 2·14	·20	27	5	78·7	26	50·7	7
,,	Polapit Tamar [Launceston]	·63	— 2·30	·14	9	15	77·6	9	38·7	7
,,	Bath	·56	— 2·27	·21	22	6	79·8	8	43·5	7
VI.	Stroud (Upfield)	·83	— 2·07	·38	9	10	81·0	26	50·0	6
,,	Church Stretton (Woolstaston)	1·36	— 1·30	·61	26	11	77·0	21	45·5	4, 28
,,	Bromsgrove (Stoke Reformatory)	·92	— 1·46	·44	1	6	80·0	21	38·0	6
VII.	Boston	1·25	— 1·19	·50	26	8	85·0	25	47·0	7
,,	Worksop (Hodsock Priory).	1·31	— 1·20	·37	26	9	83·5	14	42·5	4
,,	Derby (Midland Railway)...	·84	— 1·79	·46	26	8	85·0	8, 21	44·0	31
VIII.	Bolton (The Park)	2·46	— 1·66	·77	26	16	80·4	9	45·6	4
IX.	Wetherby (Ribston Hall) ...	1·66	— ·95	·65	22	8	...	...	...	...
,,	Arncliffe Vicarage	1·66	— 3·31	·45	22	16	...	...	...	...
,,	Hull (Pearson Park)	1·60	— ·90	·82	22	9	85·0	14	47·0	4, 19
X.	Newcastle (Town Moor) ...	1·66	— 1·25	·56	2	11	...	...	...	...
,,	Borrowdale (Seathwaite) ...	5·02	— 4·35	1·75	17	18	80·3	9	44·6	29
XI.	Cardiff (Ely)	1·69	— 1·83	1·12	1	11	...	...	...	...
,,	Haverfordwest (High St.)..	2·29	— 1·41	·84	1	15	77·6	9	45·1	7
,,	Aberystwyth (Gogerddan)..	3·12	— 1·15	·65	1	11	84·0	8	39·0	3, 27
,,	Llandudno	2·21	— ·40	·77	26	14	76·0	9	47·8	28
XII.	Cargen [Dumfries]	1·38	— 1·92	·38	29	8	83·0	9	41·0	28, 29
,,	Lilliesleaf (Riddell)	2·03	— 1·23	·47	2	12	81·0	9	40·0	28
XIII.	Edinburgh (Royal Observy.)	1·45	...	·25	2	15	75·9	21	41·4	30
XIV.	Colmonell	1·79	— 1·51	·37	21	15	82·0	9	40·0	26
XV.	Tighnabruaich	4·03	— ·30	·64	29	21	70·0	1	42·0	5
,,	Mull (Quinish)	3·75	— ·63	·58	28	25	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	1·35	— 1·68	·25	29	15	82·9	21	44·0	28
XVII.	Braemar	2·19	— ·70	·60	12	18	75·1	11	38·0	...
,,	Aberdeen (Cranford)	1·87	— 1·15	·40	2	15	78·0	14, 21	42·0	6
,,	Cawdor (Budgate)	1·92	— 1·42	·41	22	18	...	...	...	...
XVIII.	Invergarry	2·46	— 1·32	·41	9	10	...	...	...	...
,,	Bendamph.....	5·07	— 1·39	·50	16	24	...	...	...	...
XIX.	Dunrobin Castle	1·75	— 1·07	·44	9	16	72·0	7, 21	44·0	19
,,	Castletown	2·75	...	·70	27	26	71·0	14	41·0	23, 24
XX.	Killarney	1·48	— 2·51	·46	26	15	78·0	2, 9, 10	44·0	27
,,	Waterford (Brook Lodge)...	2·19	— ·91	·58	26	13	76·0	9	42·0	4
,,	Broadford (Hurdlestown) ...	1·97	— ·97	·37	28	18	77·0	9	44·0	27
XXI.	Carlow (Browne's Hill)	1·37	— 1·65	·37	9	10	...	...	...	...
,,	Dublin (Fitz William Square)	·82	— 1·81	·11	9	17	81·8	14	49·3	6
XXII.	Ballinasloe	1·04	— 2·27	·25	28	15	80 6	1	41·0	27
,,	Clifden (Kylemore House)..	2·77	— 3·38	·50	16, 22	13	...	...	...	...
XXIII.	Seaforde	1·17	— 2·23	·32	28	13	84·0	12	45·0	27
,,	Londonderry (Creggan Res.)	2·36	— 1·11	·26	28	21	...	...	...	...
,,	Omagh (Edenfel).....	2·27	— 1·12	·45	22	18	81·0	1	39·0	27
June.—	*Lilliesleaf* (Riddell)	1·99	— ·45	·90	28	7	79·0	24	39·0	4

+ Shows that the fall was above the average; — that it was below it. *a* and 25, 26.

SUPPLEMENTARY RAINFALL, JULY, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	·68	XI.	New Radnor, Ednol	2·17
,,	Ramsgate, West Cliff	·98	,,	Rhayader, Nantgwillt	1·93
,,	Hailsham	·90	,,	Lake Vyrnwy	1·65
,,	Crowborough	·50	,,	Ruthin, Plâs Dráw	2·35
,,	Osborne	·24	,,	Criccieth, Talarvor	2·51
,,	Emsworth, Redlands	·41	,,	Anglesey, Lligwy	1·54
,,	Alton, Ashdell	·24	,,	Douglas, Woodville	1·41
,,	Newbury, Welford Park	·97	XII.	Stoneykirk, Ardwell House	1·46
III.	Harrow Weald	2·61	,,	Dalry, Old Garroch	2·46
,,	Oxford, Magdalen College	·14	,,	Langholm, Drove Road	4·05
,,	Banbury, Bloxham Grove	1·58	,,	Moniaive, Maxwelton House	1·45
,,	Pitsford, Sedgebrook	·47	XIII.	N. Esk Reservoir [Penicuick]	2·70
,,	Huntingdon, Brampton	·68	XIV.	Maybole, Knockdon Farm	2·68
,,	Wisbech, Bank House	·91	,,	Glasgow, Queen's Park	2·87
IV.	Southend	·29	,,	Campbeltown, Redknowe	2·56
,,	Colchester, Lexden	·32	XV.	Inveraray, Newtown	4·46
,,	Saffron Waldon, Newport	1·64	,,	Ballachulish House	6·77
,,	Rendlesham Hall	·26	,,	Islay, Eallabus	3·54
,,	Swaffham	·66	XVI.	Dollar	3·00
,,	Blakeney	1·61	,,	Loch Leven Sluices	2·09
V.	Bishops Cannings	1·45	,,	Balquhidder, Stronvar	...
,,	Ashburton, Druid House	·50	,,	Coupar Angus Station	1·48
,,	Okehampton, Oaklands	·50	,,	Blair Atholl	1·48
,,	Hartland Abbey	2·07	,,	Montrose, Sunnyside	1·30
,,	Lynmouth, Rock House	1·24	XVII.	Alford, Lynturk Manse	3·91
,,	Probus, Lamellyn	·50	,,	Keith	1·74
,,	Wellington, The Avenue	·27	XVIII.	N. Uist, Lochmaddy	3·09
,,	North Cadbury Rectory	·72	,,	Aviemore, Alvey Manse	1·35
VI.	Clifton, Pembroke Road	·91	,,	Loch Ness, Drumnadrochit	2·45
,,	Moreton-in-Marsh, Longboro'	·38	,,	Glencarron Lodge	5·96
,,	Ross, The Graig	·67	,,	Fearn, Lower Pitkerrie	1·65
,,	Shifnal, Hatton Grange	1·82	XIX.	Invershin	1·6
,,	Wem Rectory	1·48	,,	Altnaharra	1·74
,,	Cheadle, The Heath House	2·13	,,	Bettyhill	1·20
,,	Coventry, Kingswood	1·30	,,	Watten	2·11
VII.	Market Overton	3·13	XX.	Cork, Wellesley Terrace	1·70
,,	Market Rasen	1·32	,,	Darrynane Abbey	3·06
,,	Bawtry, Hesley Hall	1·18	,,	Glenam [Clonmel]	1·27
VIII.	Neston, Hinderton	3·07	,,	Ballingarry, Gurteen	1·54
,,	Southport, Hesketh Park	1·75	,,	Miltown Malbay	2·64
,,	Chatburn, Middlewood	2·38	XXI.	Gorey, Courtown House	2·02
,,	Cartmel, Flookburgh	2·01	,,	Moynalty, Westland	1·39
IX.	Langsett Moor, Up. Midhope	1·47	,,	Athlone, Twyford	1·12
,,	Scalby, Silverdale	1·30	,,	Mullingar, Belvedere	1·69
,,	Ingleby Greenhow	1·01	XXII.	Woodlawn	2·17
,,	Middleton, Mickleton	·53	,,	Westport, Murrisk Abbey	2·90
X.	Beltingham	1·19	,,	Crossmolina, Enniscoe	2·10
,,	Font Reservoir, Fallowlees	1·12	,,	Collooney, Markree Obsy	1·59
,,	Ilderton, Lilburn Cottage	·65	XXIII.	Enniskillen, Portora	...
,,	Keswick, The Bank	1·57	,,	Warrenpoint	1·79
XI.	Llanfrechfa Grange	·69	,,	Banbridge, Milltown	1·93
,,	Treherbert, Tyn-y-waun	3·12	,,	Belfast, Springfield	1·93
,,	Carmarthen, Friary	2·23	,,	Bushmills, Dundarave	2·51
,,	Castle Malgwyn	1·81	,,	Stewartstown	2·22
,,	Plynlimon	6·80	,,	Killybegs	2·63
,,	Tallyllyn	·30	,,	Horn Head	2·52

METEOROLOGICAL NOTES ON JULY, 1905.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

London, Camden Square.—Although the temp. at no time reached an abnormally high point, the most characteristic feature of the month was the persistent heat. On every day the mean temp. was well above the average, and the mean for the month was as high as 67°·4, exceeding the average by 4°·1. This has only been exceeded in four previous Julys and in no other month; the mean min., 57°·7, was only once exceeded, reaching 58°·4 in July, 1859. Owing to the comparative absence of TS the R was considerably in defect. TS of moderate intensity occurred on 9th and 27th, T continuing almost all day on 9th. Duration of sunshine 214·8* hours, and of R only 10·2 hours.

Tenterden.—Very similar to July, 1904, as regards temp. and weather, but less sunshine and much less R. Duration of sunshine 258† hours. TS on 5th.

Crowborough.—A brilliant month without any extreme or oppressive heat. R very deficient, amounting to less than one-sixth of the average. Mean temp. 63°·8. T on 5th, 6th and 14th.

Osborne.—Dry and warm. R only 12 per cent. of the average of 48 years.

Hartley Wintney.—Glorious summer weather prevailed throughout. Very dry, without excessive heat. The nights were as beautiful as the days. Ozone on 6 days with a mean of 2·2. Absence of TS.

Addington Manor.—A fine month, nearly all the R falling on two days. Very heavy TS on 9th, causing many accidents in the neighbourhood.

Colchester.—The driest July since observations began in 1889, and continuously hot except for a few nights about 17th, but no exceptionally high max. All vegetation seriously dried up.

Brundall.—Mean temp. 65°·5, being 4°·1 above the average and 0°·4 higher than in July, 1900, which previously held the record back to 1876. T and L on 1st, 12th, 26th and 27th; T on 9th.

Torquay.—Duration of sunshine 238·9* hours or 3·0 hours above the average. Mean temp. 64°·1, being 2°·7 above the average. Mean amount of ozone 3·4.

Wellington.—A brilliant summer month with many warm days and nights, but no excessively high shade temp. R only about one-eighth of the average.

North Cadbury.—A glorious July, with high mean temp. especially at night, but small range and no extremes. A large hay crop was got in well. Entire absence of T and L.

Clifton.—Fine and warm, with occasional slight R caused by disturbances from the Atlantic. Weather of the westerly type continued nearly throughout. The last week was very sultry. R less than one-third of the average.

Ross.—The month began with heavy R, but it was fine and frequently hot afterwards. Much T on 9th.

Market Overton.—On 9th 2·07 in. of R fell in little more than an hour during a TS.

Bolton.—The temp., although at no time reaching the highest records, was decidedly above the average, the mean exceeding 60° on 13 days. Mean temp. 59°·8. Duration of sunshine 166·0* hours, or 15·2 hours above the average. TS on 9th.

Southport.—Unusually warm and sunny and decidedly dry, with an almost continuous prevalence of sea winds of normal strength. Mean temp. 2°·3 above the average; rather hot from 8th to 14th. Duration of sunshine 28 hours above the average. R 1·37 in. below the average. Evaporation exceptionally large. TS on 9th and T on 2nd.

Lilburn.—Again remarkable for small R, only 1·79 in. having fallen in three months. Corn and pastures were burnt up and water supplies running short everywhere.

LLANFRECHFA GRANGE.—Hot and close with shortage of R. Very calm, the wind force never exceeding 2. Wheat was in good order and ripening fast, but oats and barley straw short. R was much wanted and water supply deficient.

HAVERFORDWEST.—Moderately fine with temp. generally high. No TS8; a good deal of fog Crops were good, though some hay was spoilt. Duration of sunshine 193·1* hours.

ABERYSTWYTH.—Good R was rendered useless by the hot dry winds which followed, and crops suffered much.

DOUGLAS.—Fine and dry with temp. slightly above, and R considerably below, the average.

SCOTLAND.

LANGHOLM.—R ·29 in. below the average of 29 years.

TIGHNABRUAICH.—A summer temp. was maintained throughout, the mean max. being 63°·9 and the mean min. 50°·0. The R fell chiefly after sundown.

MULL.—Showery and unsettled, with wind between S. and W. throughout. Very warm. T and L on 9th and 21st.

COUPAR ANGUS.—Mean temp. 58°·7; the effect of the sunny warm days being reduced by several cold nights. The R was again short, as in every month of the year except March.

LYNTURK MANSE.—Heavy local storms, and weather of a thundery nature. A TS began at 4.45 p.m. on 2nd, was very heavy for an hour and lasted with intervals till 10 p.m. T and L on 9th, T on 10th and 11th. The temp. was high, not falling after T.

DRUMNADROCHIT.—R ·43 in. less than, and rainy days equal to, the average of 19 years.

DUNROBIN.—The drought of June lasted till the middle of July, when the weather changed and showers fell on most days.

BETTYHILL.—Beautifully fine, with a few slight showers. Crops were light in consequence of want of R.

IRELAND.

CORK.—Drought, particularly up to the 25th, caused a deficiency of water supply in the city. Although no day was remarkably warm, the high min. temp. caused the mean to be high.

DARRYNANE ABBEY.—R 81 per cent. of the average of 25 years. The first 10 days were very fine and hot; afterwards close and misty till the last week, which was sunny and moderately warm.

BROADFORD.—Favourable on the whole. Root crops were good, but oats poor and hay light. Water was very low.

MILTOWN MALBAY.—Very sultry, with sea-fogs and mist. R slight until 31st, and upland pastures burnt up. Hay crop short. Potatoes promising, but blight commencing to show.

DUBLIN.—Very warm; the mean temp. being 63°·8, or 0°·1 higher than in 1887, the previous warmest. Entire absence of electrical disturbances.

ATHLONE.—The smallest R in any July during 30 years.

BALLINASLOE.—The driest July in 34 years.

BANBRIDGE.—During a TS on 9th the L struck a tent in which a Gospel service was being held. Two lives were lost and several persons injured.

BELFAST.—The finest July for several years, and most beneficial for the farmer, especially for hay.

OMAGH.—A magnificent summer month, insuring the safety of a good average hay crop in perfect order, and with sufficient R, especially during the latter half, to supply the moisture necessary for green crops of unusual luxuriance.

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* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, February, 1905.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	54·4	5	30·6	20	47·5	37·9	38·2	87	89·6	26·9	·79	12	6·0
Malta	63·1	22	38·2	15	56·8	46·1	41·3	74	116·9	33·8	1·53	9	3·4
Lagos	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	85·8	1	55·5	3	76·8	61·4	58·1	69	...	...	·59	3	2·3
Durban, Natal	88·5	4	61·4	27	82·0	67·8	...	...	152·1	...	5·48	16	6·1
Johannesburg	80·7	2	46·8	27	73·1	55·7	56·0	82	154·0	48·5	3·30	19	5·5
Mauritius	87·5	12	69·5	26	85·3	73·7	72·1	80	152·4	64·6	3·36	17	5·7
Calcutta	86·9	25	45·9	10	75·8	54·6	51·0	60	148·4	39·9	1·62	3	3·4
Bombay	87·9	20	56·7	1	80·0	63·5	56·7	61	137·2	47·3	·08	1	1·2
Madras	91·3	27	62·0	1	87·2	70·0	68·2	73	149·7	58·4	·31	2	2·8
Kodaikanal	69·4	17	43·8	4	66·2	48·6	46·2	67	134·6	28·6	1·66	5	4·9
Colombo, Ceylon	92·4	13	68·5	12	87·4	73·0	71·0	78	156·2	64·0	2·74	6	4·4
Hongkong	73·5	24	42·8	10	58·9	51·6	51·1	84	109·9	...	1·10	11	9·2
Melbourne	101·6	10	46·6	14	76·6	55·6	51·1	62	156·4	38·0	1·83	5	4·9
Adelaide	105·4	10	46·4	13	81·0	57·2	49·3	50	168·4	41·8	·25	2	2·7
Coolgardie	105·0	17	46·4	11	85·8	59·3	49·1	45	178·8	43·2	·60	2	3·8
Sydney	95·6	23	59·8	13	77·4	64·9	59·8	68	130·8	53·1	1·86	13	5·9
Wellington	77·0	5	45·0	27	68·9	54·7	52·1	70	129·5	40·0	1·45	6	5·5
Auckland	78·0	12*a*	55·0	2, 28	73·0	58·7	55·5	70	143·0	42·0	·56	5	5·2
Jamaica, Negril Point	87·9	10	64·7	25	84·5	67·7	69·1	78	...	...	1·67	4	...
Grenada	83·4	25	68·0	1	81·2	70·2	66·4	69	147·0	...	2·11	18	7·9
Toronto	37·8	20	-8·2	4	25·3	7·7	9·6	85	59·0	—14·0	1·40	13	9·8
Fredericton	42·4	26	-21·0	20	25·8	-0·9	—3·0	58	...	...	2·75	19	4·9
Winnipeg	39·8	23	-39·0	2	13·3	-10·1	...	...	...	...	·27	3	5·4
Victoria, B.C.	56·4	26	22·7	12	46·2	37·3	...	...	...	...	2·27	10	8·2
Dawson	24·6	27	-42·4	4	1·1	-12·1	...	...	...	...	1·30	5	4·4

a—and 17.

MALTA.—Adopted mean temp. of air 51°·0 or 3°·2 below, and mean hourly velocity of wind 11·6 or 0·2 below, averages. Mean temp. of sea 56°·3. TS on 12th.

Mauritius.—Mean temp. of air 0°·4, of dew point 1°·2 above, and R 3·96 in. below, averages. Mean hourly velocity of wind 7·9 miles, or 3·1 below average. L on 12 days and T on 9 days.

MADRAS.—Bright sunshine 238·4 hours.

KODAIKANAL.—Bright sunshine 216 hours.

COLOMBO.—Mean temp. of air 80°·1, or 0°·1 below, of dew point 0°·5 above, and R ·64 in. above, averages. Mean hourly velocity of wind 6·7 miles; prevailing direction N.W. T88 on 6 days.

HONGKONG.—Mean temp. of air 55°·3. Mean hourly velocity of wind 11·3 miles; mean direction E. by N.

Adelaide.—Mean temp. of air 69°·1 or 4°·9 below the average and the lowest on record, being equalled in 1886. R ·36 in. below average.

Sydney.—Mean temp. of air 0°·1 above, R 2·95 in. below, and humidity 5·3 per cent. below, averages.

Wellington.—Mean temp. of air 0°·6 below, and R 1·77 in. below, averages.

Symons's

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METEOROLOGY AT THE BRITISH ASSOCIATION.

In the Report of the Council of the British Association, presented to the General Committee at Cape Town on August 15th, the following important statement occurs :—

The following Resolution, from the Committee of Section A, having been referred to a Committee consisting of Dr. A. Buchan, Dr. H. R. Mill, Dr. Shaw, and the General Officers, to consider and report thereon to the Council :—

The Committee of Section A desire to draw the attention of the Committee of Recommendations to the concluding portion of Sir John Eliot's Introductory Address to the Sub-Section for Astronomy and Cosmical Physics, and to express the opinion that the organisation of a Central Meteorological Department for the British Empire would be of the highest benefit to the progress of Meteorological Science and its application to the economic problems of the various Colonies and Dependencies. The object of each department would be to collect and prepare digests of the Meteorological observations taken in different parts of the Empire, to provide a scientific staff for dealing with the more general Meteorological problems, including their relations to Solar Physics and Terrestrial Magnetism, which involve the co-ordination of data from wide areas, and to promote experimental investigations of the scientific questions which arise in connection with such discoveries. The Committee desire also to express the opinion that the reorganisation of the Meteorological Office, which is at present before the Government, affords an exceptionally favourable opportunity for the establishment of such a Central Meteorological Department for the Empire.

The Memorandum that follows was drawn up by the Committee and has been approved by the Council :—

Memorandum on a Proposal for dealing with Meteorological Questions affecting the British Dominions beyond the Seas.

There is at present no provision for the systematic treatment of the meteorology of the British Dominions.

Observations of various kinds are made in nearly all the British Colonies and Dependencies, and summaries of these observations are generally included in the respective official publications. India, Ceylon, Canada, the several States of Australia, New Zealand, Mauritius, the Cape of Good Hope, and

the Transvaal have organised meteorological establishments and issue regular meteorological publications. Information with regard to the meteorology of the Crown Colonies and Protectorates is to be found in the Blue-books of the several dominions.

There is no provision for the co-ordination of the methods of observing, the instruments employed, or the presentation of results.

In 1890 the Meteorological Council published a volume of summaries of Colonial observations of the Army Medical Department and of the Royal Engineers, and recently they have published a volume of tables for tropical Africa, compiled by Mr. E. G. Ravenstein from observations practically initiated by a Committee of the British Association.

Colonial observations are sent to the Meteorological Office in accordance with a circular despatch of Mr. Chamberlain.

At the request of the Crown Agents, the Meteorological Council have recently undertaken the supervision of the supply of instruments for the Governments of the Crown Colonies. In their annual reports they have from time to time referred to the desirability of the compilation and regular issue of the results, but they have been unable to make provision for this service.

The want of a satisfactory system of co-ordinating the observations from the several dominions is to be deplored from two points of view—the economic and the scientific.

From the economic point of view, it is eminently desirable that facilities should be given for the comparison of the climatic features of the regions available for settlement and the conditions which affect various industries. At present it is possible to obtain a certain amount of information for an individual Colony by reference to Colonial Blue-books, but the data are of very different orders of completeness; and to ascertain in which Colonies specified climatic conditions are to be found would be a labour of such difficulty as to be practically prohibitive. The Board of Trade publish a certain number of tables of meteorological results among their Colonial statistics, but something of a more comprehensive character is required.

From the scientific point of view the regular issue of the meteorological data for the British Colonies in a published and easily accessible form is urgently desired by meteorologists of all countries. This is sufficiently shown by the following extract from a notice of the recent publication of the results for tropical Africa in the *Meteorologische Zeitschrift*, the leading meteorological journal :—

'To the Meteorological Council the warmest thanks of all meteorologists are due for their resolution to publish from time to time the reports of observations at colonial or foreign stations, which are collected in the Meteorological Office partly in printed form and partly in manuscript. In this journal we have repeatedly pointed out that it is in the highest degree desirable that the rich store of observations which have accumulated in the Meteorological Office, and which might be of great importance for the physics of the atmosphere as a whole, should be made generally known and available. . . . It is very desirable that this valuable publication may soon be continued.'

But there is another aspect from which the scientific treatment of meteorological data must be regarded as having an important bearing upon the economic interests of remote parts of the Empire.

Sir John Eliot, in his address to the British Association meeting at Cambridge, pointed out how the study of the meteorological conditions of the Indian Ocean and the bordering countries had been already applied to problems affecting the economic conditions of India as depending upon the variation of the monsoon rainfall, and he gave reasons for believing that the further prosecution of the inquiry promises valuable results for India, Australia, South and East Africa, and other countries bordering on the Indian Ocean if provision were made for dealing with the meteorological problem in a comprehensive manner with reference to the Indian Ocean as a whole.

Similar reasoning may be held to apply also to other oceanic areas, in or on the border of which British Colonies are situated. In this connection it should, perhaps, be mentioned that the control of the meteorological organisation of the British West Indies is already passing into the hands of the United States.

As a result of Sir John Eliot's representation, the attention of the Council of the British Association has been called to the advantages likely to accrue from the organised study of the meteorological problems affecting various groups of British dominions.

It has been further pointed out that such organised study can be most effectively secured by the establishment of a central institution devoted to these objects. Such an institution ought to be in close connection with the Meteorological Office, which is itself in regular correspondence with the meteorological organisations of foreign countries as well as those of the self-governing Colonies. The meteorology of the ocean has been an essential part of the work of the office from its establishment in 1854, and oceanic data must necessarily be appealed to for the effective study of the meteorology of the neighbouring land areas.

The President and Council of the British Association are informed that the Meteorological Office, as at present constituted, has not the means of dealing effectively with the various problems of colonial meteorology, and the suggested institution would have to be a distinct department with separate provision, whether it was in organic connection with the Office or not.

The President and Council believe that the Government of India, from their interest in meteorological investigations, would be willing to contribute their fair share towards the maintenance of such an institution, and they desire to bring the matter to the notice of the Secretary of State for the Colonies with the view of ascertaining the opinion of the various Colonies which are interested in the subject. They desire to learn whether they would be supported in an effort to obtain the establishment of such an institution as had been described.

By way of summary, the objects of the suggested institution may be briefly stated to be :—

1. To give any information that may be required to the Governments or other authorities of the British dominions as to instruments and methods to be adopted for an effective system of meteorological observations.

2. To compile and publish periodical reports upon the climatic conditions of the various parts of the Empire upon a comparable plan. To form an accessible depository of information upon matters concerning the climates of the whole Empire, and to afford information upon those subjects to inquirers.

3. To provide a scientific staff for the study of the general meteorological conditions which affect the weather in the various British dominions, and in particular to promote the formulation of meteorological laws, and to apply them to explain and ultimately to anticipate the occurrences of abnormal seasons.

A copy of this Memorandum having been forwarded to the Colonial Office, with a covering letter suggesting that the question might be moved by a deputation to the Secretary of State, Mr. Lyttelton replied that, whilst sympathising with the object which the Council had in view, he did not think that there would be any advantage in receiving a deputation until he was in possession of further information on the subject. In satisfaction of this request, the Committee drafted the following additional information :—

Draft Memorandum in further explanation of the proposal for dealing with the Meteorology of the Colonies and Dependencies, for the information of the Secretary of State.

This memorandum deals mainly with the object numbered 3 in the concluding summary of the memorandum approved by the President and Council on March 3, 1905, because the services indicated under numbers 1 and 2 would be included incidentally in the development of number 3.

The statement of the object numbered 3 is as follows :—

To provide a scientific staff for the study of the general meteorological conditions which affect the weather in the several British dominions, and in particular to promote the formulation of meteorological laws, and to apply them to explain and ultimately to anticipate the occurrence of abnormal seasons.

The idea underlying the proposal is to deal with the general meteorological conditions of wider areas than those with which the various meteorological offices of the world have hitherto been regarded as being primarily concerned. The British Meteorological Office does indeed concern itself with the meteorology of the oceans from the point of view of shipping. In effect, the proposal is to utilise further the information already obtained at sea in conjunction with land observations for the investigation of the meteorology of large ocean areas in relation to that of the adjacent land areas, and from the point of view of the land population.

It is known, for example, that the meteorological conditions of India, Australia, South Africa, East Africa, and Egypt stand in close relation to those of the Indian Ocean, and the study of these relations promises very important results in connection with the prediction of the seasons. This investigation requires that the information shall be treated in a manner different from that now followed for the more immediate purpose of its application to the interests of shipping.

The meteorological phenomena which are regarded as demanding careful study, in the first instance, are the following :—

The conditions of favourable and unfavourable seasons in India.

The droughts of Australia and South Africa.

The conditions of favourable and unfavourable Nile floods.

With those would be associated the relation of the weather of the Mediter-

rancan to the Indian cold weather anomalies, and the relation of the South Indian anticyclone to the Antarctic ice.

The larger part of the necessary land data for the investigation of these particular questions can probably be found in the publications of the meteorological organisations of India, Australia, South and East Africa, Egypt, Mauritius, Hong Kong, Singapore, or can be furnished directly by those organisations. They should be supplemented by observations contributed by certain foreign Governments. The marine data would have to be compiled from the documents collected from ships by the meteorological departments of this country and India. The further development of the collection of observations — more especially of marine data — might be necessary, in order to complete the investigation.

The use of the data would be, in the first instance, to obtain a survey of the sequence of the more general weather changes over the whole region under consideration. The first step in the operations, therefore, would be to consider the nature and extent of the data available for the purposes in view, and the form in which they should be compiled for study or for publication.

A corresponding enquiry for the Atlantic Ocean and the countries bordering upon it is equally desirable, and should be conducted concurrently in the interests of the British Isles, and the American and West Indian Colonies.

In order to carry out the proposal, something more than what would be generally understood by "a moderate addition to the staff of the Meteorological Office" is required. The proposal involves a scientific investigation of a very important character, which could not be regarded as merely an incidental addition to the usual operations of the Office. A man of suitable scientific attainments should be responsible for conducting it in consultation with, and under the general supervision of, the Director of the Meteorological Office. It is desirable to mark the nature of the qualifications expected in the person to whom the work is entrusted by giving him the title of Assistant Director, and providing a salary of from £400 to £600 a year. It should be remembered also that the Meteorological Office could not find accommodation for the proposed additional staff without some addition to the space at present available.

It is estimated that the annual cost of the work would be £2,000, rising in five years to £2,500, made up as follows :—

SALARIES:	Assistant Director	£450 to £550
	Scientific assistant, computers and clerical staff	£1,050 to £1,300
PUBLICATIONS,	printing and stationery ...	£300 to £500
INCIDENTAL EXPENSES,	office rent, &c. ...	£200 to £150

The estimate is based on the supposition that the Meteorological Committee would be willing to undertake the general control of the department as a branch of the Meteorological Office.

It may be mentioned that the Government grant to the Meteorological Office at present stands at £15,300. The cost of the marine department, as shown in the Report of the Meteorological Council for 1903–4, is £1,366, exclusive of office expenses, publications, &c.

The Council, in approving this Memorandum, has caused it to be conveyed under a covering letter to the Secretary of State for the Colonies.

ON THE USE OF BEAUFORT'S SCALE.

By R. H. Curtis.

Meteorologists who have not had much to do with wind observations, would probably be surprised to find how many and how varied are the scales employed for the estimation of wind-force in various countries, and even in different parts of the same country, and their surprise would scarcely be lessened to learn upon what an arbitrary and unsatisfactory basis many of these scales have been constructed.

A very slight consideration of the matter would suffice to show that it must always be difficult, and in many cases perhaps impossible, to satisfactorily correlate observations based upon scales which differ so greatly from each other as many of these do. For example, the scale given by Kaemtz in his "*Meteorology*," and which is, I believe, still in use, consists of only five numbers, which however are supposed to embrace the same range of wind-force as the much better known scale of Admiral Beaufort, who employed thirteen numbers for the purpose, or the scale proposed by Wild* for use in Russia, which consists of no less than nineteen points.

The descriptions of the several wind forces, which are attached to the scales for the purpose of giving to each degree a definite and recognizable value, are not always helpful to those who attempt to reduce to a common standard observations based on more than one of them. This is probably due, to some extent at any rate, to the different conceptions which the authors of the several scales had of the extreme range of force for which provision should be made. I have elsewhere pointed out that in estimating wind-force, the experience and environment of the observer counts for a great deal,† and they, no doubt, explain why one man defines a "gale" as "a wind which is dangerous for sailing vessels," whilst another is content with "single-reefed topsails," and a third considers the term justified when applied to a wind capable of "breaking exposed shrubs." To take another example, it can only be the same variety of experience which leads the author of one scale to call a wind blowing at the rate of 45 miles per hour a "storm," justifying the use of the figure 11 upon a scale of 12 points, whilst another requires a wind velocity of 99 miles per hour to warrant the use of the same figure on a similar scale. The latter had, doubtless, had experience of winds in regions over which the air moves with a freer and more unimpeded motion, and attains higher velocities than had ever fallen within the experience of the former, and in consequence the mental estimate each had formed of what constituted a "storm" was essentially different, the one requiring for it a wind moving at more than double the speed imagined by the other.

The advantage of using everywhere the same scale for observations of wind-force, and of selecting for the purpose a scale which can be

* Report of the Proceedings of the Meteorological Congress at Vienna.

† *Quart. Jour. Roy. Met. Soc.*, Vol. xxiii. p. 24.

standardized by reference to reliable anemometrical data, has been frequently urged, and is so obvious that one wonders steps have not been taken by one or other of the international meteorological Conferences to secure its adoption. Much can be said in favour of the choice of the "Beaufort" scale for this purpose. It is already very generally employed, and especially so by seamen; it rests upon a rational basis—the speed or spread of sail of a ship under given conditions; and already there exist for the scale carefully determined velocity equivalents based upon satisfactory and sufficiently numerous anemometer values. Its general use among seamen is very important, for there is no other class to whom wind observations are more useful, or by whom they are so systematically and universally made.

As regards the use of this scale on land, it has been objected that it consists of too many numbers, and that, however desirable it may be for a seaman to discriminate between, say, a "light air" and a "light breeze" (forces 1 and 2), or between a "fresh gale" and a "strong gale" (forces 8 and 9), such fine distinctions are not required, and are indeed scarcely possible for observations made on land.

To remove this supposed disadvantage what has been called the "Land Scale" has been proposed, which is merely the Beaufort scale divided by 2.* The descriptions given to the numbers of this scale are usually the same as are attached to double the same number on the Beaufort scale; but in some cases, at least, it is clear that what is meant is not that the number on the land scale and its equivalent on the Beaufort indicate the same absolute strength of wind, but only the same *relative* strength. Thus 6 on the one scale and 12 on the other alike stand for a "hurricane"; but whilst the Beaufort hurricane should indicate a wind of, perhaps, 100 miles per hour, or even more—a wind such as might be felt at sea upon our Atlantic coasts, but fortunately never inland—the land-scale hurricane would be the same wind after it had been reduced in force by its passage over hills and dales, and its contact with trees and houses and all the other friction-producing obstructions it would meet in its path, and would in reality be a very different wind indeed. In a very early publication of the Meteorological Office reference is made to the smaller wind velocities always recorded at inland stations, and to the possibility of educing for each place a factor which should enable one to eliminate this effect of friction, and get the equivalent velocity as it would be felt on the coast, thus suggesting the idea that

* I am aware it has been stated that the numbers of the "land" scale were not obtained in this summary way, but that they were really chosen as being the square roots of the pressures per square foot exerted by the winds they are taken to represent. I have, however, never been able to find anything to support this statement, and I think it more probable that it was first suggested as the origin of the scale when it was subsequently noticed that the squares of the numbers comprising the scale roughly approximate to some of the earlier suggested scales of wind pressures, all of which are empirical and very unreliable.

it is not so much the velocity actually recorded in those districts which is required, as the velocity which might have been recorded had the physical features of the district been removed or made to correspond with those on the seaboard.

The point I wish to emphasize is that the same number on the scale employed should always indicate the same force—a wind of the velocity proper to that number whether the scale be used inland or at sea. From the Annual Reports of the Meteorological Office it appears that a wind of the velocity of 44 miles per hour, which is that due to a force of 9 on Beaufort's scale, or a "strong gale," has not once been recorded by the anemometer at the Kew Observatory for some years past, although during the same interval higher estimated forces have several times been reported in the daily weather reports as having been experienced in London. This fact shows that in London the higher numbers of the scale are often attached to winds which observers at more exposed stations would place lower down. As a matter of fact, I think the higher numbers of the Beaufort scale are rarely justified at inland stations, and the highest numbers never. What is needed, then, in the absence of an anemometer, is some means by which observers can be taught to recognise, by its visible effect upon their surroundings, the velocity of the wind, and so be able to assign to it its proper position on the scale.

For this purpose, I suggest that it should be made possible, by the publication of reliable anemometrical results day by day, for observers to ascertain what was the general velocity of the wind in their district, using that word in a somewhat comprehensive way, during strong winds and gales, the observable effects of which they had been careful to note; then by associating these effects with the known velocity, they would presently form for themselves conceptions of wind velocity which would enable them, by means of the recognised equivalents, to assign to a given wind its place upon the scale more accurately and consistently than is now generally possible.

As a matter of fact, I believe some such method as this is actually used by the best observers of wind-force. From long and careful observations they have come to regard certain effects of the wind, the character of which will of course vary in different localities, as being due to certain forces, and the number on the scale by which it is to be represented is determined accordingly. For example, when I have been comparing my estimate of wind-force with that of an experienced observer, as I always do when an opportunity offers, and I have, perhaps, thought his estimate low, he has probably justified it by some such remark as this: "The boat you see out there wouldn't be carrying the sail she does with the force you suggest"; or, "With the wind from this quarter we should have a much heavier sea," thus showing that his estimate was something better than a simple guess.

(To be continued.)

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE STUDY OF THUNDERSTORMS.

ALLOW me to welcome the proposals contained in Mr. Bonacina's letter, published in the August number of your magazine, containing suggestions for a co-operative study of thunderstorms.

Little or no progress appears to have been made in this branch of climatology since the admirable report of the "Thunderstorm Committee of the Royal Meteorological Society in 1888 and 1889." A considerable number of observers in these islands must have in their possession more or less full details of thunderstorms at their stations, which have occurred since the above report.

No doubt a discussion of these, on some definite basis to be agreed upon, would be a great help to us in further elucidating the distribution &c., of thunderstorms. Probably this suggestion may not be workable, as, no doubt, considerable monetary assistance would be necessary to help in any adequate discussion of the results. Nevertheless, I have made the proposal for what it may be worth.

At the same time, there would not appear to be any insuperable difficulty in arriving at some co-operative scheme for the observation of thunderstorms occurring in the future. I, for one, should be only too pleased to lend whatever help I can to any scheme that may hereafter be formulated.

The reasons for the neglect of this fascinating branch of atmospheric phenomena one fails to see.

SPENCER C. RUSSELL, F.R.Met.Soc.

Ashley Road, Epsom, August 26th, 1905.

"LINE SQUALL" AT SIDMOUTH.

THE HON. RALPH ABERCROMBY in "Weather," 2nd edition, pp. 252 and 253, gives a description and illustration of a "line-squall." Conditions were so similar at Sidmouth, Devon, on August 22nd at 5.45 p.m., that they may be worth putting on record.

The squall passed very quickly from W. to E., and the wreath of dark heavy clouds followed by the sheet of rain was very pronounced. The rain lasted about 45 minutes and, just as it was ceasing, a most brilliant rainbow was produced.

It is to be noted that the Weekly Weather Report for 6 p.m. on the day in question, shows a secondary depression over the Irish Sea and moving eastwards.

F. DRUCE.

65, Cadogan Square, S.W., 5th September, 1905.

HAIL STORM IN SUFFOLK.

I HAVE just measured the amount of water in my rain-gauge after a heavy hailstorm, accompanied by thunder, and it amounted to ·73 in. As by far the larger amount of the fall was hail, there being a few drops of rain at the commencement and at the finish, I should say that a great deal was lost by the large hailstones jumping out of the funnel.

Some of the biggest hailstones were the size of a common hazel nut, the majority the size of a marrowfat pea and in shape like a peg-top, streaked alternately with opaque and clear ice, having a very pretty appearance. Some of the biggest were, however, quite clear ice, and of a tabloid shape.

The fall lasted from 12.40 to 1.5 p.m. (25 minutes, not more), the hail was practically confined to 15 minutes (12.45—1 p.m.). Curiously, this is our first thunderstorm this summer, though we have had many quite close to us, notably one on 30th May with 1·30 in., consequently our record for May was *2·04*, in contrast to *1·26* at Westley, Bury St. Edmunds, which is due N. about 7 miles in a beeline. I regret that I did not send you that month's record at once, for I think you would have altered your map of rainfall for May, 1905.

B. P. OAKES.

Hawkedon Rectory, Bury St. Edmunds, August 28th, 1905.

THUNDERSTORMS AND HEAVY RAINS DURING AUGUST.

A THUNDERSTORM of exceptional violence occurred over Devon and Somerset on the evening of August 15th, accompanied in many places by torrents of rain. Many instances of structural damage by the lightning are reported, buildings in some cases being set on fire and destroyed; a number of cattle are said to have been killed, but, happily, we have yet seen no report of serious injury to human life, though many narrow escapes are stated to have been experienced. The storm is described as having been of exceptionally long duration, with deafening thunder and extremely vivid lightning. According to an account given in the *Bristol Mercury*, the neighbourhood of Bath suffered severely, and the reports of damage sustained in that district are numerous. At Bridgwater the thunder was stated to have been "simply deafening" and the lightning very vivid. In the town, however, much more damage was done by the rain than the lightning, many streets being flooded and houses damaged by the inrush of water. In the surrounding country, the injury to crops from the same cause is said to have been extensive. From the reports we have received, the rainfall accompanying the storm appears to have been somewhat irregularly distributed, but no doubt the heaviest precipitation was experienced in a small area around the estuary of the Exe; and we print below letters from some of our observers who have kindly forwarded notes of their experiences:—

"I registered 3·98 in. of rain, which fell between 9 p.m. on August 15th and 9 a.m. on the 16th. I hear that 3 ins. was recorded at Dawlish, but I do not know the exact amount; over two inches fell at Kenton and Mamhead. I should like to have a photo. of the road outside my gate to show the mischief done."—C. F. BENTHALL, *Cofton Vicarage, Starcross, August 18th, 1905.*

"I send you the amount of rain registered here on Wednesday morning, 16th—2·89 in. It fell in 6 hours during a thunderstorm, and is the largest quantity of rain I have measured here in 24 hours."—D. C. STEWART, *Nidderdale, Exmouth, August 17th, 1905.*

"We had such an exceptional thunderstorm last night that I think you may be glad to hear a few particulars of it. At 8.40 p.m. on Tuesday, 15th August, a flash of lightning, thunder, and a torrent of rain came with a rush after a hot and sultry day. From that hour till about 4 a.m. on Wednesday there was no stop. This morning 3·38 inches of rain was measured, and to-day has been dry. The lightning and thunder were often simultaneous. At other times I counted 4, 5, and up to 20 between. The water-courses are scoured out and a little island has formed in the river, opposite one of the town surface-water drains, from the rubble washed down the hills. I do not hear of any death from lightning. Fire-struck objects must have been extinguished instantly by the rain. The streams were so low that there is no great flood, even with the downpour. I have never seen or heard anything so extreme in Devonshire, and all to whom I have spoken say the same."—L. J. B. G., *Charlton House, Dawlish, August 16th, 1905.*

Another remarkable fall of rain occurring during the month was that of August 24th and 25th, which affected almost the whole of Ireland, especially the eastern and central portions of the country. Dublin and district appear to have been particularly severely visited, and falls ranging from three to five inches for the two days are reported from stations in the neighbourhood. By far the larger part of this quantity fell on the 25th. The downpour, which is stated to have lasted without intermission for some 40 hours, culminated in the flooding of several small rivers on the eastern coast, occasioning much damage in many places. The most disastrous flood occurred at Bray, a fashionable health resort, 13 miles south-east of Dublin, well known for the picturesque scenery to be found in its neighbourhood. Here widespread destruction was wrought in a part of the town known as Little Bray by a sudden rise in the Dargle river, which inundated the streets making them impassable. The inmates of the houses had to be rescued by boats, and hundreds were rendered homeless. One man lost his life, and many other persons were rescued only by the greatest exertions. It is unnecessary for us to say more concerning the exciting scenes which were witnessed, as they have already been vividly described by the newspaper press all over the country. A

REVIEW.

Meteorology; or, Weather Explained. By J. G. McPherson, Ph.D., F.R.S.E. London: T. C. & E. C. Jack, 1905. Size 7 × 4½, pp. 126.

The title is misleading, for the little book which bears it does not explain the weather, nor does it show any extensive knowledge of the literature of meteorology. It is a chatty, garrulous book, with many pleasant reminiscences of personal experiences by a careful and watchful observer, but it makes no attempt to deal systematically with meteorology or with weather. The essential part is a very useful summary of Dr. John Aitken's excellent work on the phenomena of dew and on the functions of atmospheric dust. Dr. Aitken's discussion of cyclonic and anti-cyclonic movements, based on experiments, is referred to, but too briefly to be of use to the reader, and the contributions of the myriad of meteorological workers in all countries are passed over unnoticed, or barely mentioned. The necessary limits of space in a shilling book, of course, excuses many omissions.

We dissent *in toto* from the first paragraph of the chapter headed "Rain Phenomena," which runs:—

"The soft rain on a genial evening, or the heavy thunder-showers on a broiling day, are too well-known to be written about. Sometimes rain is earnestly wished for, and at other times it is dreaded, according to the season, seed-time or harvest. Some years, like 1826, are very deficient in rainfall, when the corn is stunted and everything is being burnt up; other years, like 1903, there is an over-supply, causing great damage to agriculture. The year 1903 will long be remembered for its continuous rainfall; it is the record year; no year comes near it for the total rainfall all over the kingdom."

Our annual labour is indeed in vain if the phenomena of rainfall are too well-known to be written about. The best example of a year of deficient rainfall, to the best of our knowledge, is 1887. Although 1903 was a very wet year, we found, as the result of six strenuous months spent in collating the records of 4,000 stations and comparing these with the records of other wet years, that 1872 was wetter, and 1852 only a little less wet. The details are fully set forth in "*British Rainfall*, 1903."

METEOROLOGICAL OBSERVATIONS DURING THE SOLAR ECLIPSE.

Mr. W. L. Fox has kindly forwarded particulars of the records of the self-registering instruments at the Falmouth Observatory on August 30th. The thermograph showed a slight depression at 12.30 p.m., and the temperature continued to fall very slightly till 1.15 p.m., well after the maximum phase. The barometer rose gradually and steadily throughout the day, the rise being slightly

more pronounced between 1 and 2 p.m., but there were no irregularities in the trace. The magnetic curves were somewhat unsteady, but show no special characteristics during the time of the eclipse.

Mr. C. P. Chambers, of Broughton-in-Furness, has favoured us with a diagram, showing the movements of the barometer and thermometer during the eclipse. No apparent effect is evident in the barometer record, but a decline of temperature is distinctly shown, the thermometer falling from nearly 60° at noon to 56° at 1.15 p.m. A recovery then took place, and at 3 p.m. the thermometer touched 60°, which was the maximum for the day.

A STRANGE SPECTACLE.

THE NEW ZEALAND PRESS furnishes particulars of a remarkable sight recently witnessed at various places on those islands, and we take the liberty of reprinting a portion of the monthly report, issued from the Meteorological Office at Wellington, which contains a description of the spectacle, with the impressions of several eye-witnesses :—

"On the 9th June, about three-quarters of an hour after sunset, a most remarkable phenomenon was witnessed for about twenty minutes in the western sky at places so far apart as Auckland, New Plymouth, Halcombe, Otaki, Nelson, and Hokitika. It must have been over five hundred miles away on the Tasman Sea. It may be described as a "meteoric cloud," and its appearance that of clear silver-coloured lightning. It was possibly caused by a meteor entering our atmosphere in an eastward and almost horizontal direction, and becoming luminous through combustion and disintegration into meteoric dust caused by the friction of its rapid passage through the atmosphere. At places it appeared like a long streak of luminous cloud, which gradually assumed a "Z" shape. At New Plymouth our observer, Mr. W. G. Palmer, first observed a luminous head, and afterwards another ball of light also appeared lower down. This latter shape it kept for about ten minutes, and then finally dissolved. Its azimuth is given near Auckland as about 358° ; at New Plymouth, 310°, with an altitude of 35° ; at Otaki, W.N.W., with an altitude of about 12° ; at Nelson, the azimuth 292°, and altitude 30°. Mr. A. D. MacFarlane, Meteorological Observer at Hokitika, writes : "The peculiar body of meteor which was noticed at Nelson and elsewhere was also observed here. It was noticed in the north-western heavens by a number of people, and for a time appeared to approach rapidly, then gradually faded away. It had the appearance of a large luminous body, with a long wavy ribbon-like tail." Mr. L. A. MacDonald, of Halcombe, reported : "A most extraordinary aerolite was seen in the western sky on the evening of the 9th. It traversed a zigzag course, and left a brilliant trail against the sky about 30° long ; in shape it was not unlike a streak of forked lightning. It preserved its position and luminosity for more than twenty minutes, then it became more diffused and fainter, but it retained a glow equal to that of the zodiacal light for ten minutes longer. While the trail was at its greatest brightness it far outshone the moon, which was at the time entering into her first quarter.

D. C. BATES, F.R.Met. Soc.

Meteorological Office, Wellington, 17th July, 1905."

EIGHT MONTHS' RAINFALL OF 1905.

Aggregate of Rainfall for January—August, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	15·65	101	Bolton	24·98	99	Braemar	20·72	96
Tenterden	17·42	108	Wetherby.....	14·41	86	Aberdeen	17·25	87
Hartley Wintney	15·70	98	Arncliffe	30·47	83	Cawdor	19·27	105
Hitchin	16·57	110	Hull	13·39	81	Invergarry ...	35·16	108
Winslow	14·48	87	Newcastle.....	11·51	66	Bendamph ...	50·45	102
Westley	15·50	99	Seathwaite ...	71·73	92	Dunrobin	20·15	107
Brundall	13·70	91	Cardiff, Ely ...	21·79	86	Killarney ...	29·72	85
Alderbury	18·39	107	Haverfordwest	26·30	96	Waterford ...	24·66	103
Winterbourne ...	18·18	81	Gogerddan ...	29·51	112	Broadford.....	21·56	103
Torquay	17·32	84	Llandudno ...	16·39	93	Carlow	20·83	97
Polapit Tamar ...	21·23	98	Cargen	23·25	89	Dublin	18·05	103
Bath	15·67	83	Lilliesleaf	17·61	86	Mullingar.....	22·82	99
Stroud, Upfield...	18·69	101	Colmonell	23·16	89	Ballinasloe ...	19·92	86
Woolstaston	18·95	94	Glasgow	18·20	82	Clifden	40·23	83
Bromsgrove	15·33	99	Inveraray	42·22	115	Crossmolina ...	27·51	92
Boston	14·16	98	Islay, Eallabus	30·88	115	Seaforde	23·13	97
Hodsock Priory..	11·54	74	Mull	32·98	100	Londonderry..	23·62	96
Derby.....	11·90	72	Dundee	13·55	74	Omagh	24·30	104

Although the rainfall of August has had the effect of increasing the percentages all over the kingdom, and raising the average percentage from 87 at the end of July to 94 in the present table, the rainfall for Great Britain, at least, was of so general a character that the relative distribution is little changed.

Practically all the country south of the Grampians has a rainfall well below the average of the eight months, the only exceptions being the relatively wet area in the neighbourhood of London extending into the home counties, and an isolated instance in Wales. The only well defined area with a rainfall in excess of the average is that part of Scotland cut off by the Caledonian Canal. All stations in this region had more than the normal fall. Inveraray was still, save Seathwaite, both absolutely and, jointly with Eallabus, relatively the wettest station in the table, Newcastle with two-thirds of its normal fall being the driest. The valley of the Trent is also shown to be remarkably dry. Ireland, which at the end of July was represented as having a deficiency of about 15 per cent. for the country, has now advanced to within 3 per cent. of the average fall, due to the abnormal rains attending the passage of a depression on August 24th and 25th. The eastern coast was in this instance most affected by the disturbance, and certain stations show a remarkable increase, notably Dublin, which with a deficit of 24 per cent. at the end of July, has now moved forward to an excess of 3 per cent. The south-west of the country, usually in the track of such disturbances, was on this occasion well to the west, and the fall was slight compared with the deluge visiting the Dublin district.

RAINFALL AND TEMPERATURE, AUGUST, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.
		inches	inches.	in.						
I.	London (Camden Square) ...	2·24	— ·09	·83	28	16	78·1	15	45·4	24
II.	Tenterden ...	2·47	+ ·10	·68	28	15	75·3	13	44·0	24
,,	Hartley Wintney ...	2·34	+ ·25	·57	27	17	75·0	4, 11*a*	45·0	15*b*
III.	Hitchin ...	3·25	+ ·99	·96	28	18	74·0	14	43·0	16
,,	Winslow (Addington) ...	3·03	+ ·50	·85	28	18	75·0	14, 15	43·0	17, 24
IV.	Bury St. Edmunds (Westley)	2·21	— ·19	·35	26	16	78·5	13	45·0	17
,,	Brundall ...	2·27	+ ·08	·64	29	18	77·2	21	46·0	21
V.	Alderbury ...	3·06	+ ·71	·68	3	20	84·0	15	30·0	23
,,	Winterbourne Steepleton ...	4·15	+ ·97	1·17	2	18	74·2	15	40·7	24
,,	Torquay (Cary Green) ...	3·16	+ ·25	·77	15	20	69·8	14	50·2	14
,,	Polapit Tamar [Launceston]	5·32	+ 2·13	·66	27	21	73·2	15	41·0	24
,,	Bath ...	3·98	+ 1·02	·70	25	20	74·5	15	42·2	24
VI.	Stroud (Upfield) ...	4·43	+ 1·60	·80	28	19	76·0	15, 21	48·0	23
,,	Church Stretton (Woolstaston)	4·25	+ 1·01	·87	28	19	70·0	15	43·0	31
,,	Bromsgrove (Stoke Reformatory)	5·13	+ 2·67	·80	7	19	71·0	...	39·0	...
VII.	Boston ...	2·78	+ ·53	·72	28	12	75·0	8	46·0	2
,,	Worksop (Hodsock Priory).	2·43	+ ·12	·63	25	16	74·5	15	38·7	17
,,	Derby (Midland Railway)...	2·93	+ ·51	·38	17	20	76·0	14	45·0	16, 23
VIII.	Bolton (The Park) ...	5·64	+ 1·28	1·14	25	22	73·6	15	44·5	31
IX.	Wetherby (Ribston Hall) ...	3·88	+ 1·29	·72	26	17	...	...	...	...
,,	Arncliffe Vicarage ...	5·36	— ·07	·90	19	19	...	...	...	...
,,	Hull (Pearson Park) ...	2·73	— ·08	·43	25	21	74·0	14, 21	45·0	25
X.	Newcastle (Town Moor) ...	2·57	— ·57	·57	26	24	...	...	...	...
,,	Borrowdale (Seathwaite) ...	9·77	— 1·46	1·77	17	20	72·9	15	40·4	31
XI.	Cardiff (Ely) ...	4·33	— ·19	·50	2	21	...	...	...	...
,,	Haverfordwest (High St.)...	5·47	+ 1·43	·85	27	21	72·8	15	41·6	14
,,	Aberystwyth (Gogerddan)..	6·99	+ 2·39	2·15	22	14	79·0	17	40·0	12*c*
,,	Llandudno ...	2·81	+ ·05	·80	22	16	72·0	15	46·8	14
XII.	Cargen [Dumfries] ...	3·84	— ·26	·58	17	14	74·0	15	40·0	31
,,	Lilliesleaf (Riddell) ...	4·62	+ 1·20	·80	25	20	69·0	31	30·0	4
XIII.	Edinburgh (Royal Observy.)	2·46	...	·43	28	18	67·8	4	42·4	31
XIV.	Colmonell ...	5·00	+ 1·02	·90	26	20	77·0	15	39·0	30
XV.	Tighnabruaich ...	6·59	+ 1·46	1·38	4	20	63·0	14	42·0	23, 30
,,	Mull (Quinish) ...	4·20	— ·64	·96	17	19	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	3·45	+ ·37	·75	3	17	70·6	8, 13	38·2	31
XVII.	Braemar ...	4·02	+ ·19	·70	3	22	64·9	13	38·8	9
,,	Aberdeen (Cranford) ...	3·64	+ ·42	1·00	3	22	68·0	7, 12	43·0	15, 20
,,	Cawdor (Budgate)	3·05	— ·02	·62	4	24	...	...	...	...
XVIII.	Invergarry ...	2·98	— 1·21	·45	9	13	...	...	...	...
,,	Bendamph ...	6 01	— ·90	1·02	17	24	...	...	...	...
XIX.	Dunrobin Castle ...	3·15	+ ·50	·90	3	19	64·5	8	45·5	31
,,	Castletown ...	4·24	...	·58	17	27	67·0	22	40·0	3*d*
XX.	Killarney ...	5·09	+ ·17	·61	23	22	71·5	15	43·5	8
,,	Waterford (Brook Lodge)...	5·54	+ 1·83	1·55	25	18	70·0	7, 16	40·0	22
,,	Broadford (Hurdlestown) ...	4·27	+ ·48	·87	27	22	72·0	14	44·0	21
XXI.	Carlow (Browne's Hill) ...	6·05	+ 2·54	2·12	25	19	...	...	...	...
,,	Dublin (Fitz William Square)	7·02	+ 4·00	3·44	25	22	70·0	16	46·0	31
XXII.	Ballinasloe	5·72	+ 1·76	1·45	25	20	74·2	16	40·0	2
,,	Clifden (Kylemore House)..	7·15	— ·75	1·00	31	22	...	...	...	...
XXIII.	Seaforde ...	7·82	+ 4·30	2·29	25	21	72·0	9, 15	44·0	23
,,	Londonderry (Creggan Res.)	4·46	+ ·52	·77	25	24	...	...	...	...
,,	Omagh (Edenfel) ...	4·86	+ ·83	1·05	25	23	72 0	16	41·0	7

+ Shows that the fall was above the average; — that it was below it.
a and 12. *b* and 16, 17. *c* and 13, 25. *d* and 16, 23.

SUPPLEMENTARY RAINFALL, AUGUST, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	3·45	XI.	New Radnor, Ednol	6·84
,,	Ramsgate, West Cliff	1·53	,,	Rhayader, Nantgwillt	7·86
,,	Hailsham	3·37	,,	Lake Vyrnwy	6·65
,,	Crowborough	3·30	,,	Ruthin, Plâs Drâw	4·86
,,	Osborne	2·25	,,	Criccieth, Talarvor	4·88
,,	Emsworth, Redlands	2·87	,,	Anglesey, Lligwy	3·26
,,	Alton, Ashdell	3·49	,,	Douglas, Woodville	5·50
,,	Newbury, Welford Park	3·55	XII.	Stoneykirk, Ardwell House	4·99
III.	Harrow Weald	2·54	,,	Dalry, Old Garroch	5·27
,,	Oxford, Magdalen College	2·91	,,	Langholm, Drove Road	5·79
,,	Banbury, Bloxham Grove	4·84	,,	Moniaive, Maxwelton House	4·53
,,	Pitsford, Sedgebrook	3·02	XIII.	N. Esk Reservoir [Penicuick]	3·60
,,	Huntingdon, Brampton	3·15	XIV.	Maybole, Knockdon Farm	4·43
,,	Wisbech, Bank House	1·76	,,	Glasgow, Queen's Park	3·60
IV.	Southend	1·73	,,	Campbeltown, Redknowe	4·86
,,	Colchester, Lexden	1·50	XV.	Inveraray, Newtown	6·22
,,	Saffron Waldon, Newport	2·21	,,	Ballachulish House	7·53
,,	Rendlesham Hall	1·58	,,	Islay, Eallabus	5·65
,,	Swaffham	2·84	XVI.	Dollar	3·33
,,	Blakeney	2·12	,,	Loch Leven Sluices	4·03
V.	Bishops Cannings	6·05	,,	Balquhidder, Stronvar	7·34
,,	Ashburton, Druid House	4·73	,,	Coupar Angus Station	3·33
,,	Okehampton, Oaklands	6·05	,,	Blair Atholl	3·43
,,	Hartland Abbey	3·64	,,	Montrose, Sunnyside	3·32
,,	Lynmouth, Rock House	4·99	XVII.	Alford, Lynturk Manse	4·98
,,	Probus, Lamellyn	4·66	,,	Keith	3·76
,,	Wellington, The Avenue	4·57	XVIII.	N. Uist, Lochmaddy	3·67
,,	North Cadbury Rectory	4·00	,,	Aviemore, Alvey Manse	3·37
VI.	Clifton, Pembroke Road	3·89	,,	Loch Ness, Drumnadrochit	2·58
,,	Moreton-in-Marsh, Longboro'	5·26	,,	Glencarron Lodge	8·01
,,	Rosa, The Graig	3·65	,,	Fearn, Lower Pitkerrie	2·99
,,	Shifnal, Hatton Grange	4·80	XIX.	Invershin	3·30
,,	Wem Rectory	4·20	,,	Altnaharra	3·22
,,	Cheadle, The Heath House	5·04	,,	Bettyhill	3·95
,,	Coventry, Kingswood	4·23	,,	Watten	2·78
VII.	Market Overton	2·95	XX.	Cork, Wellesley Terrace	6·77
,,	Market Rasen	3·32	,,	Darrynane Abbey	5·18
,,	Bawtry, Hesley Hall	2·50	,,	Glenam [Clonmel]	5·61
VIII.	Neston, Hinderton	3·88	,,	Ballingarry, Gurteen	5·73
,,	Southport, Hesketh Park	3·40	,,	Miltown Malbay	4·19
,,	Chatburn, Middlewood	4·88	XXI.	Gorey, Courtown House	5·57
,,	Cartmel, Flookburgh	5·77	,,	Moynalty, Westland	7·66
IX.	Langsett Moor, Up. Midhope	4·24	,,	Athlone, Twyford	5·48
,,	Scalby, Silverdale	3·20	,,	Mullingar, Belvedere	6·74
,,	Ingleby Greenhow	3·41	XXII.	Woodlawn	7·20
,,	Middleton, Mickleton	3·58	,,	Westport, Murrisk Abbey	4·73
X.	Beltingham	...	,,	Crossmolina, Enniscoe	4·41
,,	Font Reservoir, Fallowlees	4·87	,,	Collooney, Markree Obsy	5·34
,,	Ilderton, Lilburn Cottage	3·44	XXIII.	Enniskillen, Portora	...
,,	Keswick, The Bank	4·65	,,	Warrenpoint	7·63
XI.	Llanfrechfa Grange	5·15	,,	Banbridge, Milltown	5·99
,,	Treherbert, Tyn-y-waun	10·42	,,	Belfast, Springfield	6·64
,,	Carmarthen, Friary	5·58	,,	Bushmills, Dundarave	4·90
,,	Castle Malgwyn	6·06	,,	Stewartstown	7·44
,,	Plynlimon	11·10	,,	Killybegs	5·02
,,	Tallyllyn	1·80	,,	Horn Head	4·88

METEOROLOGICAL NOTES ON AUGUST, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Rather cool and cloudy. On no day did the max. temp. reach 80°, but the mean was 61°·9, or only 0°·2 below the average. Sunshine was deficient, the total duration being only 148·4* hours. A feature of the month was the number of beautiful evenings, often following stormy days. Strong winds about the middle. A short TS occurred on 5th and thundery conditions prevailed from 27th to 29th. Duration of R 40·1 hours.

ABINGER HALL.—The first and last portions were stormy, but a wonderful spell of fine weather in the middle enabled farmers to get in the harvest in good condition. Corn crops were fairly good. Sharp TSS on 22nd and 28th. Frost on 23rd.

TENTERDEN.—Rather a cold month, with showers in the first week and a good deal of R in the last. Duration of sunshine 193·3† hours.

CROWBOROUGH.—Cool and pleasant, with a considerable amount of sunshine. The R, which fell mainly in the first and last weeks, was above the average, but there was still a deficiency of 1·52 in. from January 1st. Mean temp. 58°·7.

HARTLEY WINTNEY.—The first week was wild and stormy, with TSS and sunless days. The weather improved from 7th to 18th, becoming hotter and drier. The last week was wet and stormy, with distant TSS. Ozone on 23 days; mean 2·7. Harvest and crops good.

WISBECH.—Although it was cloudy the eclipse was seen at about 0.40 p.m., the sun being then a crescent. As the darkness soon after came on, birds became greatly excited, swallows, swifts and other small birds flying wildly about till 1.15 p.m., when they seemed to settle.

BURY ST. EDMUNDS.—Warm and dry with high max. temp. Very favourable for harvest till 26th; then good R, which was much wanted for roots.

BISHOPS CANNINGS.—Harvest began early but was greatly hindered; the greater part was, however, carried by the end of the month. On 15th 1·52 in. of R fell, nearly all between 8 and 10 p.m. with T.

TORQUAY.—Duration of sunshine 188·9* hours, or 18·4 hours below the average. Mean temp. 60°·3, or 1°·3 below the average. Mean amount of ozone 4·7.

OKEHAMPTON.—Very wet, with an exceptional fall of 1·72 in. on 15th, all coming down in about 2 hours during a TS.

WELLINGTON.—A great contrast to July, being unsettled, wet and cool almost throughout. R about 1·75 in. above the normal. The TS on 15th and 16th was very severe. The temp. reached 70° on 6 days only.

NORTH CADBURY.—Ranking, as regards temp., with the miserable Augusts of 1902 and 1903, the max. temp. being very low, but nights not cold. A very bad gale, lasting 24 hours, ended at 7 p.m. on 4th. T on 5th and T and L on 1st, 15th, 27th and 29th, that on 29th being preceded by terrific inky blackness in the N. although the storm was not severe. The eclipse was well seen.

ROSS.—Unsettled and showery month, but very fine from 11th to 16th. Harvest was somewhat hindered. Two slight TSS.

WORKSOP.—Showery, with no hot weather. The R for the last 12 months was only 15·25 in., or 39 per cent. below the average.

BOLTON.—Mean temp. 56°·1, being 1°·2 below the average; 60° was reached on only two days. Duration of sunshine 115·2* hours, or 3·1 hours below the average. TS on 17th, which was responsible for the death of a man in the neighbourhood; some trees were also damaged. T and L on 28th and T on 9th.

SOUTHPORT.—Dull, with low and unsteady bar., but in nearly all other respects fairly normal. Mean temp. 0°·7 below the average. Duration of sunshine 26* hours below the average, and R ·39 in. under the average. Duration of R 44·4 hours. Underground water level unprecedentedly low.

LILBURN.—The R was abundant and most beneficial to growing crops and pastures, but it retarded harvest operations. T8S almost absent. Temp. normal.

LLANFRECHFA GRANGE.—The R on the first 6 days was very acceptable as scarcity of water was anticipated. Very warm in the early part. Harvest was early and well housed.

HAVERFORDWEST.—A wet and stormy month ; fine and warm from 10th to 16th, broken weather afterwards. Crops were good, but much damaged by the wet. Duration of sunshine 154·0* hours.

GOGERDDAN.—Rather wet and very cold, with frequent gales from E., N.W. and W. R was badly needed and did good to root crops but afterwards damaged harvest crops.

DOUGLAS.—Following the dry and often warm weather from May to July, this month came in with strong winds and distinctly cool conditions. On 17th the weather completely broke up, with violent gales and heavy R to 26th, during which period 3·85 in. fell. Then gloomy, wet and cold to 30th.

SCOTLAND.

CARGEN.—Warm and genial, harvest operations being very general during the latter half. T on 3rd and 9th, L on 18th. The eclipse was seen very well.

LILLIESLEAF.—There were many very heavy and continuous showers ; hay and corn suffered much and could not be got in. Silent T8 on 25th.

INVERARAY.—Unsettled and showery throughout, with hardly any warm days.

COUPAR ANGUS.—The R was practically normal and the mean temp. 56°·9 or 1°·2 above the average, this being due to warm nights.

ABERDEEN.—Wet, with little sunshine and light winds. Good crops and harvesting going on, but trying weather.

DRUMNADROCHIT.—R ·36 in. below, and rainy days 5 above, the average of 19 years. On the whole cold and unseasonable. Thick fog all day on 27th.

CASTLETOWN.—Sunless, cold and damp throughout. Farmers were just beginning to cut barley at the end.

IRELAND.

CORK.—The R was the greatest since 1892, when it reached 8·50 in. Remarkably low temp., the mean being 55°·5. During the eclipse the temp. fell 4° during the period when it generally rises 2°.

DARRYNANE ABBEY.—A bad month with a few very fine days. R 13 per cent. over the average.

WATERFORD.—From 24th to 27th 3·05 in. of R fell with some H. T on 3rd and 4th. Fog on 14th and 17th. Mean temp. 57°·0. The eclipse was seen well.

BALLINGARRY.—Continuous R for 36 hours from 8 p.m. on 24th, yielding 2·81 in.

DUBLIN.—Changeable and cool and notable for the excessive R. Nearly half the total fell on 25th, when 3·44 in. was measured. The mean temp. was 58°·5, and the prevailing winds were N.W. and W.S.W.

BANBRIDGE.—R 2·79 in. above the average of 40 years. On 25th 2·25 in. fell, the greatest fall since October 12th, 1865.

BELFAST.—The wettest month since October, 1903, owing to the R on 25th and 26th, when 3·00 in. fell, making the wettest spell since August, 1883. Fortunately there was comparatively little damage by flooding.

OMAGH.—Except for a fine spell in the second week the month was rainy and unsettled and unfavourable for harvest operations. The most noteworthy circumstance was the heavy general R on 26th, but the moisture coming from the S. and E. the clouds had deposited their extraordinary burden before reaching here and only 1·05 in. fell.

* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, March, 1905.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	60·9	22	27·0	4	52·8	38·5	40·9	87	102·8	21·1	3·00	21	7·2
Malta	...	...	...	...	...	...	...	...	...	...	...	...	...
Lagos	93·0	9*a*	72·0	2	90·0	77·7	75·3	72	146·0	66·5	1·48	9	5·3
Cape Town	95·4	18	52·6	5	79·0	60·6	58·2	70	...	...	1·00	5	3·8
Durban, Natal	88·7	12	58·7	18*b*	80·1	64·3	...	...	144·4	...	4·07	15	4·7
Johannesburg	80·4	13	42·0	18	69·8	52·6	53·7	86	142·2	42·2	3·42	14	5·1
Mauritius	86·7	1, 6	64·7	27	83·4	72·4	72·2	85	153·2	58·9	14·98	27	8·2
Calcutta	94·7	30	61·4	21	86·2	67·4	67·0	74	150·9	57·5	3·48	9	5·3
Bombay	86·7	15	62·0	2	82·8	70·4	65·6	71	134·4	54·1	·09	0	2·3
Madras	96·9	31	68·8	6	90·4	75·2	71·5	73	150·0	65·8	·85	3	3·4
Kodaikanal	73·3	13	45·9	6	67·6	51·1	47·4	67	138·4	32·1	2·34	11	3·2
Colombo, Ceylon	93·7	6	72·0	5	89·3	76·6	76·9	75	154·0	67·0	1·27	4	5·6
Hongkong	77·0	14	47·2	5	61·8	56·3	55·9	88	125·1	...	11·49	20	9·6
Melbourne	96·1	19	44·0	13	73·6	52·4	49·0	63	143·0	33·7	·96	5	4·6
Adelaide	101·6	18	46·7	11	79·3	56·0	49·0	54	156·0	43·2	·15	4	3·2
Coolgardie	99·6	7	44·0	20	85·1	58·3	49·2	45	159·0	39·9	·17	2	2·4
Sydney	89·9	10	59·4	14	75·2	63·8	61·3	75	126·0	50·1	8·98	19	3·4
Wellington	73·2	13	45·8	19	65·9	54·8	52·7	76	123·0	42·0	5·39	14	6·3
Auckland	78·0	3	53·0	9	71·1	57·9	54·0	69	142·0	43·0	2·54	6	3·8
Jamaica, Negril Point	85·0	14	64·9	4	83·6	68·2	68·3	76	...	...	3·73	10	...
Trinidad	90·0	1	63·0	1*c*	86·4	66·8	73·7	87	163·0	60·0	3·74	12	...
Grenada	85·6	31	68·4	26	82·2	71·8	70·1	78	150·0	...	4·70	17	3·9
Toronto	64·0	29	5·7	5	38·7	22·5	23·2	79	72·3	1·0	·51	7	5·5
Fredericton	57·7	30	-18·5	15	37·9	12·6	13·5	54	...	...	1·15	6	4·4
Winnipeg	57·7	26	-19·5	12	32·9	14·8	...	...	...	...	1·78	11	6·2
Victoria, B.C.	68·0	9	31·3	29	53·1	42·6	...	...	...	...	1·39	18	7·0
Dawson	41·6	28	-17·6	16	21·3	2·2	...	...	...	...	·40	2	...
Trinidad January	88·0	17	61·0	31	85·0	66·3	68·5	79	158·0	57·0	2·41	10	...
Trinidad February	90·0	25,26	62·0	4	85·6	65·3	67·2	74	165·0	58·0	·59	8	...

a and 13, 14. *b* and 19. *c* and 19, 20.

Mauritius.—Mean temp. 0°·1 below, dew point 1°·7 above, and R 5·82 in. above, averages. Mean hourly velocity of wind 8·8 miles, or 1·6 below average; extremes, 30·1 on 30th and 0·0 on 25th; mean direction E.S.E. L and T 1st to 4th, 6th to 8th, 13th, 14th, 19th and 22nd; L on 5th, 15th and 31st; T on 10th and 12th.

MADRAS.—Temperature was higher than usual. TS8 on 3 days; distant TS8 on 2 other days, and distant L on 4 other days. Bright sunshine on 227·6 hours.

KODAIKANAL.—Bright sunshine on 222 hours.

HONGKONG.—Mean temp. of air 58°·9. R 8·85 in. above 20 years' average. Mean direction of wind E.; mean hourly velocity 17·9 miles. Bright sunshine 31·1 hours.

Adelaide.—Mean temp. of air 67°·6 or 2°·6 below, R ·91 in. below, averages.

Sydney.—Mean temp. of air 0°·2 above, humidity 0·5 below, and R 3·81 in. above, averages.

Wellington.—Mean temp. of air 0°·2 below, and R 2·23 in. above, averages.

Auckland.—Mean temp. of air above average, and R 1·00 in. below average.

Symons's
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THE BRITISH ASSOCIATION IN SOUTH AFRICA, 1905.

The meeting of the British Association in South Africa has been a remarkable departure from the traditions of three-quarters of a century, not because it took place beyond the seas, for the Association met at Montreal in 1884, and at Toronto in 1897, but because never before has a meeting been held at a number of separate centres several days' journey apart. New rules were introduced to deal with the new conditions. It was arranged that only members of the Association who had attended earlier meetings, or who had been specially elected by the Council, should be eligible for the special privileges offered by the Union Castle Shipping Company and the Colonial and Municipal authorities in South Africa. A smaller number received the greater privilege of being included in the "Official Party," all of them being present or past officers of the Association, or of the Sections, and this party was favoured with priority in the abounding hospitality lavished on the Association by the people of South Africa, a hospitality so great that it created an uneasy feeling in some minds that it could never be adequately repaid. We believe, however, that the visit of the Association will be productive of real and lasting good to South Africa.

Most of the members of the official party left Southampton on board the Royal Mail Steamer *Saxon*, on July 29th, and the voyage was one of remarkable comfort and interest. The huge vessel of more than 12,000 tons was favoured by calm weather to within a few hundred miles of the Cape, and only on the last day of the voyage was the motion sufficient to make it necessary to have "fiddles" on the tables to control the dishes at meals. The weather was, however, nearly always dull, and surprisingly cool. Only on one day, when passing Cape Verde, was the temperature as high as it had been for a week before our departure from London. The warmth increased slightly, on the whole, from the Channel until the noonday sun became vertical on August 4th, in 20° N.; thereafter, when the North-East Trades gave place to the South-West monsoon of West Africa, and that in turn changed gradually into the South-East Trades, it grew steadily cooler. On the equator, blankets, which had been discarded at Madeira as an encumbrance, came into

favour once more, and long before the south temperate zone was entered upon it became uncomfortably cool for sitting on deck at night without an overcoat.

The President of the Association, Professor G. H. Darwin, of Cambridge, and the Presidents of most of the Sections, were on board, and on the initiation of Mr. Maylard, of Glasgow, a series of short impromptu lectures was arranged, which proved both pleasant and profitable. Amongst these lectures two had some bearing on meteorology, one by Professor W. M. Davis, of Harvard University, given in 1° N., on August 7th, on the Weather of the Atlantic; the other by Dr. H. R. Mill, in 15° S., on August 10th, on the Bed of the Sea and the circulation of its waters. For a week there were two well-attended lectures each day, but that did not interfere with the ordinary ship's sports, which went on with the usual enthusiasm.

The *Saxon* reached Capetown early in the morning of Tuesday, August 15th, and the routine of a British Association meeting commenced immediately. The sectional meetings were not well attended as a rule by the over-sea members, and occasionally very small numbers were present when important papers were being read. Indeed it was generally felt that the primary objects of the Association were better pursued by excursions in the neighbourhood than by presence in the buildings where the sections met.

At the meeting of the General Committee on the afternoon of the 15th, the Report of the Council of the Association was received, and this contained a remarkable resolution regarding the co-ordination of the meteorological services of the British Empire, which we published *in extenso* last month. The meteorological papers were, unfortunately, scattered through several sections, as owing to some unexplained decision of the Council, the Sub-Section of Cosmical Physics, which has been so successful in recent years, was not continued. There were papers enough both in the Astronomical and the Meteorological departments to have made a very successful sub-section, but they suffered from being taken simultaneously in some cases, so that no discussion was possible, while in other cases limitations of time made brevity the first essential. We hope to publish abstracts of the more important papers falling within our scope, and at present give the titles only.

AUGUST 16th, Wednesday.

Prof. Beattie, Mr. Lyle, and Mr. Logeman.—*Observations on Atmospheric Electricity in South Africa.* (Section A).

Mr. A. R. Dwerryhouse.—*Report of the Committee on the underground waters of North-West Yorkshire.* (Section C).

Discussion on the effect of Climate upon Health. Speakers—Sir T. Lauder Brunton, Prof. McKendrick, Dr. Gregory, Dr. Jasper Anderson, Prof. Bohr, Dr. J. A. Mitchell, Dr. C. F. K. Murray, Dr. Jane Waterston, Dr. J. Hewat, Dr. Cassalis, Dr. Fuller, Mr. J. Barcroft. (Section I).

AUGUST 17th, Thursday.

Prof. J. C. Beattie and Prof. J. T. Morrison.—*The Magnetic Survey of South Africa.* (Section A).

Mr. A. W. Rogers.—*Glacial Periods in South Africa.* (Section C).

Prof. A. Penck.—*Changes of Climate as Movements of the Snow Line and Upper Tree Limit since Tertiary Times.* (Section C).

AUGUST 18th, Friday.

Dr. H. R. Mill.—*Comparison of the long-period rainfall records at Capetown and Greenwich.* (Section A).

Mr. C. Stewart.—*The Climatology of South Africa.* (Section E.)

The Meteorological Breakfast was arranged by Mr. Charles Stewart, Secretary of the Cape of Good Hope Meteorological Commission, but on account of the distance from the centre at which many of the visitors lived, and the difficulty of communicating with them, the attendance was much smaller than usual, and many of the over-sea members who were warmly interested in the subject were unable to be present. The following were at the breakfast, which took place on Friday, August 18th, at the Grand Parade Restaurant:—

H. L. Attridge	Sea Point, nr. Capetown.
L. C. Bernacchi	London.
Henry Bohns	Kenilworth, nr. Capetown.
J. Edmund Clark	Croydon.
Richard H. Heward ...	Sea Point, nr. Capetown.
W. A. Legg	Capetown.
R. H. Meunard	Woodstock, nr. Capetown.
Hugh Robert Mill	London.
R. C. Wynne Roberts ...	Capetown.
Charles M. Stewart ..	Capetown.
Thomas Stewart	Capetown.
W. H. Taylor	Capetown.

Dr. H. R. Mill briefly explained the origin and nature of the annual meteorological breakfast of the British Association, and expressed his admiration of the work being done with very inadequate resources by the Cape of Good Hope Meteorological Commission. He hoped that the time might come when the meteorological services of South Africa would be consolidated into one system, and assimilated with that of the rest of the British Empire, in accordance with the resolution passed by the General Committee. Mr. J. E. Clark also made some remarks, and Mr. Charles Stewart replied on behalf of the local meteorologists.

On Saturday, August 19th, a very interesting series of excursions took place to Table Mountain, the parties going and returning by different routes, but meeting at the reservoirs of the Capetown Waterworks, where lunch was served by the kindness of the Capetown Corporation. One party returned through the Woodhead Tunnel, which carries the water-main for a distance of over 2000 feet through the mountain. The exquisite beauty of the surroundings of Capetown in the early spring, and the remarkable hospitality of the people, made the leave-taking very regretful when the last of the British Association party sailed from Table Bay on the night of the 19th.

ON THE USE OF BEAUFORT'S SCALE.

By R. H. Curtis.

(*Continued from p.* 140.)

In Vol. XXIII. of the *Quart. Jour. Roy. Met. Soc.* I have given the results of a determination I made of the velocity equivalents of the numbers of Beaufort's scale, for which I employed several thousands of anemometer observations made exclusively at stations where the instruments are satisfactorily exposed. The results are repeated in the following table :—

Table I.

Estd. Force by Beaufort's Scale	0	1	2	3	4	5	6	7	8	9	10	11	12
Mean Velocity Equivalent... In miles per hr. (Curtis' method).	2	4	7	10	14	19	25	31	37	44	53	64	77

After my results had been published I received a letter from Dr. Köppen, of the Hamburg Seewarte, in which he called my attention to a proposal he had made for obtaining the equivalents by a slightly different method to that I had adopted. My plan had been to group under each point of Beaufort's scale the corresponding anemometrical value for each estimation recorded, and then to find the mean velocity value for each point. Dr. Köppen reversed this process, and got his result by sorting out under each velocity the corresponding estimated forces, and thus finding the mean Beaufort scale value for every mile of velocity. At first sight one might think the results by both methods would be identical, but such is not the case. For the middle numbers of the scale the velocity equivalents are the same, but for the lower numbers they are smaller, and for the higher numbers they are larger by Köppen's method than by mine.

The reason for this difference is as follows :—when we compare a number of observations of a given force with the corresponding anemometer values, we always find that the latter cover a considerable range of velocity. In looking for the cause of this we must remember that an estimated force represents the impression conveyed to the mind of the observer by what he observes at a particular moment, or during a brief period, whilst the anemometer value represents the average speed of the wind during a complete hour, of which the moment of observation is but the mid-way point.

Since the wind does not always blow with uniform strength throughout an hour, it is easy to see how an increase or decrease in its force at some part of the interval will account for some of these variations in the velocity equivalents, whilst others are no doubt due to errors of estimation on the part of the observer himself, whose ultimate award is certainly arrived at, if he be an intelligent observer, through the agency of more than one of his senses.

Thus, in analysing the observations I used for my equivalents, so

as to find the mean velocity-equivalent for the same estimated force, but for winds blowing from different quarters, I found that the mean velocity for a moderate gale (force 7) from the north-east was 11 per cent. *less* than that got from the same observer's estimates of a moderate gale from the west, and for this result the well-known "feel" of the polar wind must, I think, have been largely responsible.

Now Köppen's method enables us to sort out these over and under-estimates (regarding all the differences as such), and to find the velocity which most frequently agrees with each estimated value. If the over-estimates of a given force are equal in number to the under-estimates, they will balance each other, and the result will be the same mean velocity-equivalent, whether the observations are dealt with by the method I employed, or by that of Köppen, and this is what actually happens as regards the middle values of the scale.

But when we come to the lower numbers of the scale it is found that the under-estimates of force somewhat preponderate, and therefore Köppen's method gives distinctly lower velocities as the equivalents of forces below 3. On the other hand, with force 8 and upwards, the over-estimates are the more numerous, and the result is that for these forces Köppen's method yields higher velocity equivalents than are obtained when the observations are dealt with by the method I followed.

The values yielded by Dr. Köppen's method are given in the following Table II. They are obtained from precisely the same observations as were used for Table I., but they progress rather more symmetrically, and form a smoother curve when presented in that form.

TABLE II.

Values of Beaufort's Scale ...	0	1	2	3	4	5	6	7	8	9	10	11	12
Mean Velocity Equivalents ... In miles per hour. (Köppen's method).	0	1	4	9	14	20	26	33	42	51	62	75	92

It will be seen that up to the force of "7" the differences between the two sets of equivalents are not serious, but that from force "8" upwards they grow rapidly, the values got by Köppen's method being much higher than those got by my own.

Until now I have not published these figures, although Dr. Köppen has, I believe, done so, I having sent them to him in 1897. My opinion is that upon the whole they are the better ones to adopt, and the only reason I have to offer for their non-appearance earlier, and it is probably an insufficient one, is that I hesitated to disturb so soon values which I had reason to suppose had been pretty generally adopted.

To revert again, now, to the objection made by some to Beaufort's scale on the ground that its sub-divisions of wind-force are too

minute, I should like to make a suggestion by way of concluding this article. The suggestion is this: that whilst those who desire to do so should, of course, continue to use the scale without abridgment—and these will probably include most observers at land stations, as well as all seamen—they should adopt as its basis the velocity equivalents given in Table II. as having been determined by a method of calculation which is, upon the whole, preferable to that used for the values given in Table I.

Those, however, who prefer a scale of fewer numbers might divide the scale into groups, as follows:—

Beaufort's Scale.	Description of Wind.	Equivalent Mean Velocity.
0	Calm.	0 miles per hour.
1 to 3	Light airs.	1 to 10 ,, ,,
4 ,, 6	Moderate breezes.	11 ,, 30 ,, ,,
7 ,, 8	Gale.	31 ,, 45 ,, ,,
9 ,, 10	Hard gale.	46 ,, 65 ,, ,,
11	Storm.	66 ,, 80 ,, ,,
12	Hurricane.	81 and above ,, ,,

It will be noticed that the velocities corresponding to this classification of wind-force arrange themselves in groups, which are very convenient for remembering. The first group of three figures embraces a velocity of 10 miles, and the second group also of three figures a range of 20 miles; the third and fourth groups are each of two figures, and cover a velocity range of 15 miles and 20 miles respectively, whilst the next number has 15 miles, and the maximum limit of the hurricane is literally, as well as figuratively, "in the air"!

SUMMARY OF THE RESULTS OF BRITISH THUNDERSTORM COMMITTEE, 1888—89.

By L. C. W. Bonacina.

The Committee of British Thunderstorms was appointed by the Council of the Royal Meteorological Society at the end of the year 1887 to organize observations of thunderstorms occurring in the south-east of England. The discussion of these observations, made chiefly in the south-east of England but also in other parts of the country, which was confined to those of the years 1888 and 1889, was undertaken by Mr. W. Marriott (see *Quart. Jour. Roy. Met. Soc.*, January, 1892,) in the absence of the Hon. Ralph Abercromby, the originator of the scheme; and, though the observations only extended over two years, it resulted in the acquisition of some definite knowledge relating to thunderstorms, viz.:—

(1). The hours of maximum frequency of thunderstorms are from 12 noon to 4 p.m.; those of minimum frequency are 1.0 a.m. to 7.0 a.m.

(2). The average rate of travel of thunderstorms in ill-defined low pressure systems is about 18 miles per hour, but the rate of those storms that occur in squally cyclonic weather is greater.

(3). Thunderstorms appear to be unconnected with the absolute height of the barometer, they are connected only with its relative height—*i.e.*, with the distribution of atmospheric pressure.

(4). Thunderstorms usually occur in ill-defined low pressure systems, or in the space, or "col," between two anticyclones.

(5). From synoptic charts showing differences of pressure of ·02 inch, constructed for the month of June, 1888, it was apparent that the seemingly ill-defined areas of low pressure contained a number of small distinct low pressure systems with wind circulation in many respects similar to ordinary cyclones, and that the districts traversed by these small depressions were those which reported thunderstorms; moreover, from these charts it was also evident that storms occurred where the direction of the surface wind differed from that of the upper currents.

(6). Thunderstorms apparently circulate round the area or areas of lowest pressure in these "ill-defined" low pressure systems, and travel in the direction of the prevailing wind.

(7). When thunderstorms accompany large cyclonic depressions they usually occur in the south-eastern quadrant of the latter; (ordinary eastward moving cyclones).

(8). The movements of thunderstorms seem to be controlled less by the configuration of the land and contour of the hills than by the distribution of atmospheric pressure.

(9). A violent whirl of wind at some little distance above the surface of the earth is usually associated with thunderstorm depressions; occasionally this whirl of wind is felt at the surface.

(10). Damage effected by lightning seems to be associated with numerous oscillations of the barographic record; a sudden increase of pressure of three or four hundredths of an inch frequently precedes a heavy fall of rain in thunderstorms.

(11). Thunderstorms probably do not as a rule exceed an altitude of about 5000 feet above the earth's surface.

(12). An upward current of air is apparently an essential constituent of a thunderstorm formation.

Two interesting instances of "line" thunderstorms during the two years 1888 and 1889 were reported (May 18th-19th, 1888, and

June 2nd, 1889.) These storms, which directly traversed England from south to north at the rate of 50 miles per hour, were similar in character, and were associated with a similar type of weather, pressure on both occasions being low over the Atlantic and high over Scandinavia. The important question was raised by Mr. Symons as to whether the thunderstorms themselves travelled or whether the thunderstorm *conditions* were transmitted along the traversed path.

In the above summary of the report of the Thunderstorm Committee published in the *Quarterly Journal of the Royal Meteorological Society* for January, 1892, we have only included those apparent facts which may be considered to be representative of thunderstorms in general, and have omitted those which can only be said to relate to the particular storms of 1888 and 1889 upon which the observations were made; obviously, from two years' observations, no light could be thrown upon such questions as the geographical and seasonal distribution of thunderstorms.

The distribution of thunderstorms over England and Wales for the years 1871 to 1887 has been studied by Mr. Marriott, and appears to have been very irregular, showing no definite relation to latitude (see *Q.J. Roy. Met. Soc.*, Jan., 1890, pp. 1-4). We believe that future study of the distribution of thunderstorms over England will show that it is related to the geographical features of the different districts, and scarcely at all to the geographical positions.

[We are much indebted to Mr. Bonacina for undertaking the task of preparing a summary of the reports of the Thunderstorm Committee, which may be looked upon as an excellent preliminary to the formulation of the scheme suggested in our August issue (p. 118) for a systematic study of British Thunderstorms. We shall look forward with interest to developments in this direction, and hope to be able to give publicity to its results from time to time.—Ed. *S.M.M.*]

EXPLORATIONS OF THE ATMOSPHERE.

In a recent number of *Science* appeared an interesting account of some experiments carried out at St. Louis with *ballons-sondes*, for the purpose of investigating the meteorological conditions at great heights above the American continent. The experiments were a continuation of those described in previous Nos. of the same journal, and were conducted by Mr. Clayton, under the direction of Mr. A. Lawrence Rotch, of the Blue Hill Observatory. The German expanding rubber balloons filled with hydrogen by the vitriolic process were employed, and nine ascents were made during January, February and March, 1905. In all instances but one the balloons and attached instruments were returned, in accordance with the instructions addressed to the finders, and all descended within the eastern half of a circle having its centre at St. Louis and a radius of 285 miles. On January 25th, at an altitude of 48,700 feet, and when a high barometric pressure

prevailed on the earth's surface, a temperature of —111° F. was registered, this being one of the lowest natural temperatures ever recorded. The experiments are to be continued during the present summer, the success hitherto attained having induced the Secretary of the Smithsonian Institution to make a grant of $1,000 for that purpose from the Hodgkins' fund.

The kite experiments at the Blue Hill Observatory, a short account of which we published in our issue of October last, are also being continued; flights being made in each month on the days appointed by the International Committee for Scientific Aeronautics, whilst in addition they are employed to ascertain the conditions prevailing above the Atlantic Ocean in the Trade wind region. In connection with this enquiry the author continues:—

"Thus the investigation which was first proposed by Mr. Rotch, and which has been persistently advocated by him since, is now in progress, and this was rendered possible through the co-operation of the well-known French meteorologist, M. L. Teisserenc de Bort, who placed his steam yacht at the disposal of Mr. Rotch, on condition that the latter should share the expense of the cruise. Accordingly, on June 3rd, Mr. Clayton sailed from Boston for the Mediterranean on board the White Star steamer *Romanic*, equipped for raising self-recording instruments with kites, as was first done in 1901 by Messrs. Rotch and Sweetland on a voyage from Boston to Liverpool. A despatch from Mr. Clayton, at Gibraltar, announced that flights had been made on six days, and a mean height of 3,000 feet attained. The results of aerial soundings in the region of permanent high pressure around the Azores, and near the northern limit of the north-east trades, are expected to prove of special interest. At Gibraltar, Mr. Clayton is to embark on the *Otaria*, a yacht of 350 tons, which its owner has already employed for kite-flying in European inland waters. The boat will proceed south, touching at Madeira, Canary and Cape Verde Islands, and perhaps go as far as St. Paul, near the equator, returning by a more westerly course to the Azores, the whole voyage occupying about six weeks. On this route the north-east trade-winds and doldrums are traversed, and the south-east trades entered. Should there be too little wind, either at the surface or higher up, the speed of the vessel will enable the kites to rise, and, should the wind at any time be too strong, by steaming with it the pull of the kites can be moderated. By this method it is hoped that all the strata up to a height of 15,000 feet or more will be penetrated, so that their condition as regards temperature, moisture and wind may be investigated. Besides determining the depth of the north-east trade-wind, the supposed south-west, or return trade, which has only been observed on the Peak of Teneriffe, will be sought, and its height above the ocean in different latitudes measured, but in case the kites do not reach a sufficient altitude, it is proposed to liberate small balloons from Madeira, and observe their change of direction as they rise. Professor Hergesell, on board the Prince of Monaco's yacht, executed last summer a series of kite-flights in the region between Spain, the Canaries and the Azores, without encountering the upper anti-trade, and the present expedition expects to make similar soundings in these and lower latitudes, and will also attempt to extend them to greater heights."

Correspondence.

THE STUDY OF THUNDERSTORMS.

To the Editor of Symons's Meteorological Magazine.

BEFORE commencing any fresh attempt to record thunderstorms, would it not be well to find out what material already exists in the hands of the Committee of the Royal Meteorological Society? You state, on p. 120 of your August number, that they have not made any report since 1889; but the collection of material went on long after that: in fact, I am still recording particulars of thunderstorms in the little books they have supplied, and it may be that many others are doing the same, although I have ceased sending reports to the Committee.

T. W. BACKHOUSE.

West Hendon House, Sunderland, 2nd October, 1905.

ANOTHER NEGLECTED METEOROLOGICAL ITEM.

Is not the recording of the snow lying on, or covering, the ground neglected in this country, although recorded in others? I always record this item, as well as the average depth when the ground is covered. Is it not of some importance, as affecting districts other than the place of observation? Here in winter the bitterest winds we get are from the south, and I incline to attribute this to the larger distance of snow-covered ground in that direction than any other, but this is merely a guess, as one has no information to go by. I do not know how far the coldness of the south wind applies to other stations, nor whether the suggested explanation would apply elsewhere. It would be interesting to hear whether such were the case.

T. W. BACKHOUSE.

West Hendon House, Sunderland, 3rd October, 1905.

HEAVY RAIN IN INDIA.

MR. J. DOUGLAS MAYNARD, writing from Seoni Malwa, in the Central Provinces of India, writes to Mr. T. P. Newman as under, and Mr. Newman has forwarded the extract to us for publication:—

"We have had excellent rains so far, and a good break of fine weather this week, facilitating ploughing and sowing. It looks as if rain were coming up again in force to-night.

"In thirty-six hours ending 8 a.m. on July 8th, we had 19 inches of rain in Seoni, 13 inches within the latter twenty-four hours. There was a great flood (said to be a record), several houses destroyed and cattle drowned, and a section of our only metalled road washed clean away, leaving only the natural soil. A part of the Orphanage boundary wall, which had been built probably during the missionary's temporary absence, and had its lime facing neatly put on before his return, betrayed its construction by 'flowing down,' as the people put it."

Unfortunately, says Mr. Newman, there are other districts, notably the Native State of Rajputana, where the rainfall is very deficient.

BEN NEVIS OBSERVATORY AND THE ARGENTINE REPUBLIC.

THE following letter appeared in *Nature* of September 14th last:—

News has reached me here from the office of the Scottish National Antarctic Expedition in Edinburgh of the appointment of almost the whole of the Ben Nevis Observatory staff to the Argentine Meteorological Office, including the Superintendent, Mr. Angus Rankin, who has been associated with the observatory for more than twenty years, Mr. Robert Macdougal, for many years assistant, and Mr. Bee.

It may be remembered that in March, 1903, the Scottish National Antarctic Expedition set up a first-class meteorological and magnetical station in the South Orkneys, at Scotia Bay, and that, after the wintering of the *Scotia*, I offered to hand over the station, including Omond House and Cope'and Observatory, to the Argentine Government, with eighteen months' provisions, as well as to give a passage on board the *Scotia* to Argentine men of Science if the Republic would undertake to continue the work and relieve the party the following year. This was carried through by the energy of Mr. Walter G. Davis, director of the Argentine Meteorological Office, and Mr. Robert C. Mossman, the Scottish expedition's meteorologist, was asked to continue in charge. Now Mr. Mossman has returned after two years' valuable work in the Antarctic, and the station is being kept up a third year—the first time in the history of Antarctic exploration that scientific observations have been carried on in one place for more than two years.

But the Republic is not satisfied; it is to continue the work for still another year, and is even going to increase the number of Antarctic stations. Trained men were required, and since Mr. Mossman's return he has been in communication with Mr. Davis, with the result that these three gentlemen have been appointed to carry on this work, as well as Mr. W. R. Bruce, also of Ben Nevis Observatory, who arrived in Buenos Aires three weeks ago.

The Argentine Republic must be congratulated on its enlightened perspective; but surely while doing so we must hang our heads in shame, for, while our Government has discouraged scientific research, we find this rapidly rising Republic eager to encourage it.

WILLIAM S. BRUCE.

Eggishorn, Switzerland, September 8.

NILE FLOODS AND ATMOSPHERIC PRESSURE.*

THE study of the relations existing between the variations of atmospheric pressure in north-east Africa and the fluctuations of the Nile Flood, has hitherto been considerably handicapped by the assumption that the volume of water brought down by the White Nile, rising in the Equatorial Lakes, was not greatly inferior to that supplied by the Blue Nile, which drains the Abyssinian plateau. It is now, however, recognised that the Blue Nile, when in flood, holds back the waters of the White Nile to such an extent that the latter may be practically ignored as a factor in the seasonal inundations.

Few observations of barometric pressure exist for the upper parts of the Nile Valley, and it is necessary to rely entirely on the records at Cairo, Alexandria and Beirut, for information as to normal conditions and seasonal variations over any long period. The rainfall of Abyssinia is due to the monsoon of eastern Africa, and corresponds to pressure variations affecting a very wide area; a certain degree of similarity to the south-west monsoon rainfall of India is evident. The barometric conditions in northern Egypt may, therefore, be relied upon as giving a very fair approximation to those of the districts further to the south.

Practically the whole of the Abyssinian rainfall is deposited between April and September, 90 per cent. of the annual fall taking place from June to September; it is consequently only in these six months that any relation between pressure and flooding can be expected to exist.

If the yearly variations of pressure from April to September are examined, it will be seen that their oscillations are generally inverse to those of the Nile Flood, as indicated by the gaugings at Aswan, years of high pressure corresponding to those of low rainfall, and *vice-versâ*. In 33 years a mean pressure in excess of the normal occurred with 12 low floods and 7 high ones, while a deficient mean pressure accompanied 14 high floods and no low ones. If the curves of the anomalies of the two elements are compared, it is further evident that the divergencies from the normal of the two curves show a marked tendency to move in the same direction. Of 18 years with an increase of pressure, 2 only had an increase in flood, and in 14 years with a decrease in pressure, but 5 had a smaller flood.

In several of the years in which discrepancies occurred, it is noticeable that the pressure conditions in northern Egypt exhibited marked differences from those of India, and accorded closely with those of the Azores, indicating that the Mediterranean system extended into Egypt on these occasions. It is possible, therefore, that the conditions in Abyssinia were not in these instances fairly represented by the Cairo readings.

* On the Relation between Variations of Atmospheric Pressure in North-East Africa and the Nile Flood. By Capt. H. G. Lyons. Communicated by Dr. W. N. Shaw. *Proc. Roy. Soc.* Vol. **A** 76 (1905), pp. 66–86. Plate.

The coincidence of the two curves is even more clearly shown if the monthly means are plotted, even brief temporary fluctuations being sometimes traceable. Apparent discrepancies, existing in the six-monthly curves, are also in most cases explained by this means.

Taking the 35 years, 1869–1903, Captain Lyons is of the opinion that in six years out of seven a very fairly accurate prediction of the flood from month to month could have been made.

METEOROLOGICAL NEWS AND NOTES.

We regret to see announced the death, in his sixty-ninth year, of Dr. W. von Bezold, professor of physics and meteorology at the University of Berlin, and director of the German Meteorological Institute. He was also for many years an honorary fellow of the Royal Meteorological Society.

Competitive Meteorology.—To many curious competitions must be added a French novelty that is the most curious of them all. It was a tourney meteorological, and its conditions were to divine correctly in advance the weather on 15 consecutive days in fickle September. Seven competitors entered, and three achieved, or are stated to have achieved, success, predicting the weather for the successive days with a precision which is described as almost mathematical. It is a pity that we are not told more of these infallible meteorologists.

In Berwickshire and East Lothian serious floods have been caused by a remarkable rainstorm of 48 hours' duration—the first for months. Great stretches of land lay under water, and in at least eight instances houses were flooded, causing the inmates to beat a hasty retreat. Turnips and potatoes were practically washed out of the drills, and the outlook caused grave concern to agriculturists. An exceptionally high tide at the same time made considerable encroachment on land on the Haddington coast.

Mr. G. B. Buckton, F.R.S., F.L.S., well known for his contributions on entomological and other subjects to the Transactions of the Royal Society, died on September 25th, in his eighty-eighth year. Mr. Buckton had kept a record of rainfall at his residence at Weycombe, near Haslemere, for nearly forty years.

The Council of the Royal Meteorological Society have now appointed a lecturer who is prepared to deliver lectures on Meteorological subjects—*e.g.*, How to Observe the Weather; Weather Forecasting; Climate; Rainfall; Thunderstorms; Meteorology in Relation to Agriculture, Health, &c. The lectures will be illustrated by lantern slides from the large collection in the possession of the Society. The Council are willing to arrange for exhibiting at the gatherings of local scientific societies, institutions or schools, a collection of photographs, diagrams and charts illustrating meteorological phenomena, and various patterns of instruments used for meteorological observations.

NEWS was received on September 29th of the death of Rear-Admiral Sir William James Lloyd Wharton, K.C.B., F.R.S., who succumbed to enteric fever and pneumonia, at Capetown, where he remained after the departure of the British Association party. After being engaged many years in marine surveying, he was appointed Hydrographer to the Admiralty in August, 1884, in which position he remained until his retirement in 1904. Sir William Wharton was the author of "Hydrographical Surveying," and edited the "Journal of Captain Cook's First Voyage Round the World." He was also, for some time, a member of the Meteorological Council.

THE DRY WEATHER of the past summer has had the effect of lately rendering it necessary for some of the large towns to practice economy in the matter of water supply. Liverpool had recently to restrict its service to 13 hours a day, its sources of supply, viz., Lake Vyrnwy and the Rivington Reservoirs, both showing a shortage. At Loughborough also, where the reservoirs are stated to be lower than for twenty years, the same course had to be adopted. A glance at the aggregate table of rainfall shows this district to be within the region of the greatest deficiency, and as for 1904 also, it was within an area well below the average, the cumulative deficiency must be very great. The town of Bath and the Cleveland district have also been among the sufferers, and in many rural districts the scarcity of water has been severely felt. The heavy rains of June, which did much to alleviate the effects of the drought in the south, did not apparently extend far beyond the boundaries of the home counties, and in the Midlands and North of England the three months, May, June and July, were all dry, May and July in a particular degree, and these conditions, combined with the active evaporation of those months, are no doubt accountable for the general shortage of water in those districts.

BOOKS RECEIVED.

The Croydon Natural History and Scientific Society. Report of the Meteorological Committee for 1904. Prepared by F. Campbell-Bayard, LL.M., Hon. Sec. Size 8½ × 5½. Pp. 59.

Results of Meteorological Observations in New South Wales during 1900, 1901, and 1902, under the direction of H. C. Russell, B.A., C.M.G., F.R.S. Sydney, 1904. Size 10 × 6. Pp. 216.

Results of Rain, River and Evaporation Observations made in New South Wales during 1901-2, under the direction of H. C. Russell, B.A., C.M.G., F.R.S. Sydney, 1904. Size 9½ × 6. Pp. 423+xc. Maps and diagrams.

Jahrbuch des Norwegischen Meteorologischen Instituts für 1904. Herausgegeben von Dr. H. Mohn. Christiania, 1905. Size 13 × 10. Pp. 138.

Osservatorio di Messina. Annuario per l'anno 1904. Messina, 1905. Size 9½ × 6½. Pp. 87. One plate.

Annual Report of the Central Meteorological Observatory of Japan for the Year 1902. Part I., Meteorological Observations in Japan. Tokio, 1905. Size 12 × 8. Pp. 329.

Annuario publicado pelo Observatorio do Rio de Janeiro, 1905. Anno XXI. Rio de Janeiro, 1905. Size 7 × 5. Pp. 336.

NINE MONTHS' RAINFALL OF 1905.

Aggregate of Rainfall for January—September, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	17·74	100	Bolton	28·24	95	Braemar	22·69	91
Tenterden	19·89	106	Wetherby.....	16·40	85	Aberdeen	19·67	86
Hartley Wintney	17·86	97	Arncliffe	35·06	83	Cawdor	21·09	99
Hitchin	18·59	107	Hull	14·83	78	Invergarry ...	39·43	104
Winslow	15·90	84	Newcastle.....	13·47	68	Bendamph ...	59·34	103
Westley	16·92	93	Seathwaite ...	79·98	88	Dunrobin	22·26	103
Brundall	15·72	89	Cardiff, Ely ...	23·67	81	Killarney ...	32·45	82
Alderbury	19·70	100	Haverfordwest	28·55	90	Waterford ...	26·50	98
Winterbourne ...	20·94	81	Gogerddan ...	32·45	106	Broadford.....	23·72	100
Torquay	19·18	81	Llandudno ...	17·68	86	Carlow	22·45	92
Polapit Tamar ...	23·01	91	Cargen	25·12	84	Dublin	19·28	98
Bath	17·33	80	Lilliesleaf	20·10	86	Mullingar.....	24·08	92
Stroud, Upfield...	19·57	92	Colmonell	26·06	86	Ballinasloe ...	22·03	84
Woolstaston	20·10	88	Glasgow	20·26	80	Clifden	45·51	83
Bromsgrove	16·14	91	Inveraray	47·81	112	Crossmolina ...	30·43	89
Boston	16·48	98	Islay, Eallabus	35·37	112	Seaforde	24·18	89
Hodsock Priory..	12·75	72	Mull	38·94	101	Londonderry..	26·18	93
Derby	13·10	69	Dundee	14·70	71	Omagh	26·74	100

Another month, characterised by pronounced dryness, has had the effect of still further aggravating the widespread deficiency of rainfall which has now become general in almost all parts of the British Isles. The only area of any size which still shows an aggregate fall since January 1st, 1905, in excess of the average, is situated in the west and north of Scotland, but even in this area, nowhere except in the south of Argyllshire, did the fall surpass the average by more than a trifling amount. Here the two relatively wettest stations, Inveraray and Eallabus, had excesses of 12 per cent. A small area still remains in the south-east of England where the fall is somewhat above the normal amount, and Aberystwyth stands by itself with 106 per cent. of the average. Elsewhere the fall has been consistently in defect, most notably in the North Midlands of England and on the east coast from Dundee to Hull. In both of these areas considerable portions have received less than three-quarters of their usual rainfall to the end of September.

Speaking generally the distribution remains remarkably similar to that at the end of August, with a falling off which is most marked in the south-west of England, in Wales and the east of Ireland.

RAINFALL AND TEMPERATURE, SEPTEMBER, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	2·09	— ·20	·70	25	12	76·5	3	42·7	15	0	0
II.	Tenterden	2·47	— ·15	·80	9	14	74·0	6	40·0	15, 16	0	0
,,	Hartley Wintney	2·16	— ·22	·49	25	12	75·0	4	35·0	21	0	0
III.	Hitchin	2·02	— ·24	·95	26	14	72·0	3	36·0	14	0	0
,,	Winslow (Addington)	1·42	— ·90	·62	25	14	75·0	3	32·0	15	2	0
IV.	Bury St. Edmunds (Westley)	1·42	— 1·07	·55	25	10	74·0	3	39·0	21	0	—
,,	Brundall	2·02	— ·55	1·05	24	13	74·0	3	41·0	15, 17	0	0
V.	Alderbury	1·31	— 1·22	·44	9	12	76·0	4	...	...	...	...
,,	Winterbourne Steepleton ...	2·76	— ·64	1·22	9	9	72·0	3	35·6	27	0	0
,,	Torquay (Cary Green)	1·86	— 1·19	·82	5	11	72·4	3	43·1	22	0	0
,,	Polapit Tamar [Launceston]	1·78	— 1·85	·37	9	17	68·5	4	31·6	22	2	2
,,	Bath	1·66	— 1·23	·59	9	9	69·5	5	36·0	21	0	0
VI.	Stroud (Upfield)	·88	— 1·84	·30	6	10	71·0	4, 5	42·0	14	0	—
,,	Church Stretton (Woolstaston)	1·15	— 1·59	·31	9	10	66·0	5	38·0	21, 24	0	—
,,	Bromsgrove (Stoke Reformatory)	·81	— 1·51	·26	8	7	71·0	...	31·0	...	2	—
VII.	Boston	2·32	+ ·02	·61	25	11	70·0	3	37·0	21	0	—
,,	Worksop (Hodsock Priory).	1·21	— ·97	·37	9	13	72·4	4	31·7	15	1	0
,,	Derby (Midland Railway)...	1·20	— 1·12	·49	9	13	74·0	4	32·0	26	1	—
VIII.	Bolton (The Park)	3·26	— 1·12	·89	9	18	62·5	7	38·5	15	0	0
IX.	Wetherby (Ribston Hall) ...	1·99	— ·54	·52	9	15	...	...	...	...	...	...
,,	Arncliffe Vicarage	4·59	— ·54	1·09	9	22	...	...	...	...	...	...
,,	Hull (Pearson Park)	1·44	— ·96	·49	9	12	70·0	2	37·0	15	0	0
X.	Newcastle (Town Moor) ...	1·96	— ·40	·29	9	20	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	8·25	— 4·51	1·49	9	18	62·1	3	34·1	21	0	—
XI.	Cardiff (Ely)	1·88	— 2·20	·57	9	13	...	...	...	...	...	...
,,	Haverfordwest (High St.)..	2·25	— 1·96	·81	9	11	68·2	13	34·7	15	0	0
,,	Aberystwyth (Gogerddan)...	2·94	— 1·26	1·15	9	12	69·0	5,7,20	31·0	14a	3	—
,,	Llandudno	1·29	— 1·63	·49	9	15	67·2	5	43·0	21, 27	0	—
XII.	Cargen [Dumfries]	1·87	— 1·84	·34	1	11	65·0	4	33·0	21	0	—
,,	Lilliesleaf (Riddell)	2·49	— ·28	·55	27	21	69·0	4	29·0	20	1	0
XIII.	Edinburgh (Royal Observy.)	1·24	...	·45	27	13	64·7	5	39·7	30	0	0
XIV.	Colmonell	2·90	— 1·18	·71	1	13	68·0	4	33·0	14, 25	0	—
XV.	Tighnabruaich	4·19	— 1·34	·61	2	18	58·0	1·5,16	39·0	25	0	0
,,	Mull (Quinish)	5·96	+ ·49	1·26	6	22	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	1·15	— 1·40	·45	26	16	70·3	3	36·2	21	0	—
XVII.	Braemar	1·97	— 1·30	·46	8	16	64·8	18	29·8	21	1	—
,,	Aberdeen (Cranford)	2·42	— ·62	·70	26	19	71·0	4	30·0	20	2	—
,,	Cawdor (Budgate)	1·82	— 1·19	·28	25	20	...	...	...	...	...	...
XVIII.	Invergarry	4·27	— ·85	1·12	7	9	...	...	...	...	...	...
,,	Bendamph	8·89	+ ·61	1·10	7	23	...	...	...	...	...	...
XIX.	Dunrobin Castle	2·11	— ·60	·30	9	16	66·0	17	38·5	21	0	—
,,	Castletown	3·11	...	·89	2	23	68·0	6	37·0	21	0	—
XX.	Killarney	2·73	— 1·94	·57	9	21	67·0	1, 5	38·5	15	0	—
,,	Waterford (Brook Lodge)...	1·84	— 1·24	·54	8	13	70·0	3	35·0	15, 26	0	—
,,	Broadford (Hurdlestown) ...	2·16	— ·78	·45	5	20	66·0	5, 6	36·0	12	0	—
XXI.	Carlow (Browne's Hill)	1·62	— 1·18	·24	6	15	...	...	...	...	...	...
,,	Dublin (Fitz William Square)	1·23	— ·92	·26	27	14	68·1	4	38·5	26	0	0
XXII.	Ballinasloe	2·11	— 1·06	·39	8	22	67·0	3	33·0	15, 16	0	—
,,	Clifden (Kylemore House)..	5·28	— 1·44	1·11	8	16	...	...	...	...	...	...
XXIII.	Seaforde	1·05	— 2·32	·21	4	11	68·0	5	37·0	26	0	0
,,	Londonderry (Creggan Res.)	2·56	— 1·21	·65	9	21	...	...	...	...	...	...
,,	Omagh (Edenfel)	2·44	— 1·11	·46	8	21	65·0	4	32·0	25	1	0

+ Shows that the fall was above the average; — that it was below it. a and 16, 25.

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	2·02	XI.	New Radnor, Ednol	2·09
,,	Ramsgate, West Cliff	2·48	,,	Rhayader, Nantgwillt	2·38
,,	Hailsham	2·90	,,	Lake Vyrnwy	2·88
,,	Crowborough	2·67	,,	Ruthin, Plâs Drâw	1·52
,,	Osborne	2·59	,,	Criccieth, Talarvor	1·49
,,	Emsworth, Redlands	2·21	,,	Anglesey, Lligwy	1·92
,,	Alton, Ashdell	2·18	,,	Douglas, Woodville	2·10
,,	Newbury, Welford Park	1·80	XII.	Stoneykirk, Ardwell House	2·47
III.	Harrow Weald	1·55	,,	Dalry, Old Garroch	2·11
,,	Oxford, Magdalen College	1·16	,,	Langholm, Drove Road	3·90
,,	Banbury, Bloxham Grove	·99	,,	Moniaive, Maxwelton House	2·10
,,	Pitsford, Sedgebrook	1·35	XIII.	N. Esk Reservoir [Penicuick]	3·10
,,	Huntingdon, Brampton	1·55	XIV.	Maybole, Knockdon Farm	3·07
,,	Wisbech, Bank House	3·40	,,	Glasgow, Queen's Park	2·06
IV.	Southend	1·62	,,	Campbeltown, Redknowe	2·90
,,	Colchester, Lexden	1·07	XV.	Inveraray, Newtown	5·59
,,	Saffron Waldon, Newport	1·35	,,	Ballachulish House	9·76
,,	Rendlesham Hall	2·89	,,	Islay, Eallabus	4·49
,,	Swaffham	2·83	XVI.	Dollar	1·35
,,	Blakeney	2·05	,,	Loch Leven Sluices	1·79
V.	Bishops Cannings	1·39	,,	Balquhidder, Stronvar	...
,,	Ashburton, Druid House	2·43	,,	Coupar Angus Station	1·36
,,	Okehampton, Oaklands	1·71	,,	Blair Atholl	2·03
,,	Hartland Abbey	1·67	,,	Montrose, Sunnyside	1·51
,,	Lynmouth, Rock House	2·79	XVII.	Alford, Lynturk Manse	2·35
,,	Probus, Lamellyn	1·06	,,	Keith	3·07
,,	Wellington, The Avenue	1·59	XVIII.	N. Uist, Lochmaddy	5·26
,,	North Cadbury Rectory	1·45	,,	Aviemore, Alvey Manse	1·92
VI.	Clifton, Pembroke Road	1·33	,,	Loch Ness, Drumnadrochit.	1·84
,,	Moreton-in-Marsh, Longboro'	1·18	,,	Glencarron Lodge	11·12
,,	Ross, The Graig	1·47	,,	Fearn, Lower Pitkerrie	1·82
,,	Shifnal, Hatton Grange	1·05	XIX.	Invershin	2·06
,,	Wem Rectory	1·32	,,	Altnaharra	3·05
,,	Cheadle, The Heath House.	1·36	,,	Bettyhill	3·11
,,	Coventry, Kingswood	1·83	,,	Watten	2·38
VII.	Market Overton	2·93	XX.	Cork	1·35
,,	Market Rasen	1·79	,,	Darrynane Abbey	3·82
,,	Bawtry, Hesley Hall	1·14	,,	Glenam [Clonmel]	1·66
VIII.	Neston, Hinderton	1·60	,,	Ballingarry, Gurteen	1·83
,,	Southport, Hesketh Park	2·25	,,	Miltown Malbay	3·39
,,	Chatburn, Middlewood	3·59	XXI.	Gorey, Courtown House	1·72
,,	Cartmel, Flookburgh	4·02	,,	Moynalty, Westland	1·56
IX.	Langsett Moor, Up. Midhope	2·14	,,	Athlone, Twyford	1·97
,,	Scalby, Silverdale	2·10	,,	Mullingar, Belvedere	1·26
,,	Ingleby Greenhow	3·64	XXII.	Woodlawn	2·92
,,	Middleton, Mickleton	2·04	,,	Westport, Murrisk Abbey	2·82
X.	Beltingham	2·30	,,	Crossmolina, Enniscoe	2·92
,,	Font Reservoir, Fallowlees.	2·69	,,	Collooney, Markree Obsy	2·33
,,	Ilderton, Lilburn Cottage	2·85	XXIII.	Enniskillen, Portora	1·78
,,	Keswick, The Bank	4·32	,,	Warrenpoint	·87
XI.	Llanfrechfa Grange	2·59	,,	Banbridge, Milltown	1·34
,,	Treherbert, Tyn-y-waun	4·60	,,	Belfast, Springfield	1·99
,,	Carmarthen, Friary	3·18	,,	Bushmills, Dundarave	2·76
,,	Castle Malgwyn	2·00	,,	Stewartstown	2·03
,,	Plynlimon	5·50	,,	Killybegs	2·78
,,	Tallyllyn	3·80	,,	Horn Head	3·33

METEOROLOGICAL NOTES ON SEPTEMBER, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—More or less mixed weather prevailed until 11th, with not infrequent R but no great deficiency in sunshine. On 12th more settled conditions set in, with lower night temp. and much sunshine. The last week was dull and rainy with greatly reduced range of temp. After the first ten days of the month there was a conspicuous absence of wind movement. Duration of sunshine 104·1* hours and of R 31·7 hours. Of the latter 11·9 hours occurred on 25th. Mean temp. 57°·1. or 0°·6 below the average.

TENTERDEN.—Rather wet generally except in the third week. Sunshine was deficient, amounting to 109† hours only.

CROWBOROUGH.—Cool and pleasant, with several days of brilliant sunshine. R ·18 in. above the average, thus reducing the deficiency for the year to 1·34 in. Prevailing winds S. and W. for the first 13 days and N. and E. for the remainder. Mean temp. 54°·8. TS on 6th.

HARTLEY WINTNEY.—A pleasant month, but rather cool. The first and last weeks were stormy with R, but summer returned from 10th to 25th. Ozone on 25 days with a mean of 3·5. L on 28th.

PITSFORD.—On the whole a pleasant month. R 1·25 in. below the average. Mean temp. 54°·1.

WISBECH.—On 25th 2·20 in. of R fell, the heaviest daily fall since the register was commenced in 1859.

BRUNDALL.—Mean temp. 0°·7 below the average. There were few really warm days and much rough chilly wind. No R fell from 10th to 23rd inclusive.

WINTERBOURNE STEEPLETON.—Another month of deficient R. Of the total, 2·76 in., 2·52 in. fell on 5 days, 5th to 9th, and on 14 consecutive days ending on 27th no R was registered and the weather was generally very fine. Temp. slightly below the average.

TORQUAY.—Duration of sunshine 153·2* hours, or 11·3 hours below the average. Mean temp. 57°·1, being 1°·2 below the average. Mean amount of ozone 4·4; max. 7·0 on 9th with S.W. wind, and min. 2·0 on several days.

POLAPIT TAMAR.—The first 10 days were wet, the remainder dry and seasonable.

NORTH CADBURY.—The day temp. was the lowest in September for nine years, the max. reaching 70° only three times, but the night temp. was about normal. Wet and extremely boisterous during the first ten days, and high wind again in the last eight days; the intervening days being calm and fairly sunny. The wind was from N. or E. almost exclusively after the 10th, and after 13th only ·10 in. of R fell.

CLIFTON.—Fine and dry except for a rainy period from 6th to 10th, with strong S. and S.W. winds. N. or N.E. winds prevailed from 10th to the end, with rather low temp. R nearly two inches below the average.

ROSS.—Fine and warm for the first five days, rainy and cool from 6th to 9th, very fine but cool from 10th to 27th, and afterwards gloomy, cold and showery to the end. R only half the average.

BOLTON.—The first half was mild and wet, with S. and W. winds, and the latter cold and dry, with N. or E. winds. Duration of sunshine 69·4* hours, or 17·7 hours below the average. Mean temp. 52°·4, or 1°·7 below the average. Heavy dews from 14th to 22nd

SOUTHPORT.—Dull and cool throughout, but with S.W. gales and excessive R during the first fortnight, and light N.E. winds and practical absence of R during the remainder. Duration of sunshine 29* hours below the average. R 1·07 in. below the average. Mean temp. 2°·0 below the average.

HULL.—Fine generally, with low R. Duration of sunshine 96* hours. Dense fog on 18th.

LILBURN.—The beginning and end of the month were unsettled, with much R. Warm in the middle and cold later, with frost on 20th, which, however, did little damage. The R was beneficial and much wanted. No gales or T88.

LLANFRECHFA GRANGE.—A fine month with early harvest, which was mostly housed by 14th. Wheat was good but oats and barley poor. The R in the first nine days improved roots very much.

CARMARTHEN.—Wet and stormy during the first week; afterwards particularly fine with abundant sunshine.

HAVERFORDWEST.—Mild and wet up to 10th, but much colder from that date to the end, it being the driest and coldest September for 50 years. Duration of sunshine 133*·4 hours.

ABERYSTWYTH.—The first fortnight was very wet, but there was grand dry weather for the remainder. The wind was chiefly S.W. and S. early in the month, and later E. and S.E. Cold throughout without much sun, but drying winds, making good weather for getting in crops.

SCOTLAND.

CARGEN.—One of the driest Septembers recorded. Damp, muggy weather during the first half interfered with harvest operations in the earlier districts, but there was splendid harvest weather from 15th to 30th.

LANGHOLM.—R ·39 in. below the average of 29 years.

INVERARAY.—The first half was very wet, the latter fine and dry enabling harvest operations to be carried on successfully.

MULL, QUINISH.—The incessant R of the first half was followed by N. and E. winds and bright sunshine.

COUPAR ANGUS.—R ·75 in. short of the average. There were no extremes of temp., but the maxima were high owing to sunny days. Mean temp. 52°·3.

LYNTURK.—The first three weeks had very fine harvesting weather, farmers remarking that they remembered no better. Continuous rainy days in the last week.

DRUMNADROCHIT.—R ·91 in. below, and rainy days equal to, the average of 19 years. The middle of the month was cold and clear with some frost, which injured foliage.

DUNROBIN CASTLE.—The first fortnight was wet and showery, but there was good harvest weather between 13th and 25th.

WATTEN.—The opening and closing days were wet and cloudy. For the rest fine harvest weather with light winds.

IRELAND.

CORK.—A cold month, the temp. being 2°·3 below the average. Prevailing winds N.W. and N.E.

DARRYNANE.—Although the total R was only 87 per cent. of the average there were but few dry days until the last week.

MILTOWN MALBAY.—Much R in the first half, the second being dry with high easterly winds.

DUBLIN.—A favourable but cool month. Westerly winds prevailed during the first part, north-easterly during the latter, whilst the middle was quiet and dry. The first seven days were warm, the remainder distinctly cool and autumnal. Mean temp. 54°·9, or 1°·0 below the average.

BANBRIDGE.—R 1·46 in. below the average of 40 years.

BELFAST.—The driest September since 1895. Average R in the first half with dull weather. Strong N. or N.E. winds towards the end.

OMAGH.—The first half was unsettled, rainy and humid, doing considerable damage to outstanding crops. The latter half, however, accompanied as it was by strong polar and eastlerly winds, although abnormally ungenial for the time of year, dried the ground and the grain, and resulted in a fairly well saved harvest.

* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, April, 1905.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	64·7	13	31·6	8	55·6	41·0	41·2	83	108·3	26·4	1·75	19	7·8
Malta	...	...	...	...	...	...	...	...	...	...	...	...	—
Lagos	92·0	14*a*	72·0	28	89·4	77·6	75·1	72	145·0	65·0	4·88	9	6·3
Cape Town	87·0	27	38·9	23	73·3	55·5	55·1	74	...	...	·05	1	4·9
Durban, Natal	87·8	24	61·0	27	81·3	63·8	...	...	141·3	...	·89	10	3·1
Johannesburg	74·8	2	44·4	14	70·3	52·0	51·2	73	138·9	39·5	1·54	16	1·4
Mauritius	84·4	8	65·7	30	81·4	70·5	68·9	81	147·6	57·1	1·98	16	6·2
Calcutta	98·8	9, 19	60·9	2	91·3	71·7	70·7	73	155·9	55·1	4·98	6	4·9
Bombay	88·3	17	68·1	1	85·9	73·9	71·1	76	136·8	53·9	·00	0	1·7
Madras	94·7	29	75·4	19	91·6	77·7	74·0	76	149·7	73·9	·56	2	4·3
Kodaikanal	72·5	27	51·8	7	67·3	53·6	52·0	77	144·9	41·4	3·79	20	5·3
Colombo, Ceylon	91·7	3	73·6	9	87·8	76·7	74·3	82	152·8	71·8	6·26	16	6·0
Hongkong	84·2	27	51·8	4	72·0	63·7	63·7	85	134·8	...	1·24	13	8·8
Melbourne	88·4	7	38·8	21	69·6	52·4	50·8	72	144·2	31·5	3·02	8	5·0
Adelaide	91·7	6	47·0	3	73·9	55·3	49·9	61	144·0	40·1	3·66	11	4·6
Coolgardie	92·4	16	42·2	6	77·0	53·6	47·7	52	158·0	34·2	·95	6	4·4
Sydney	79·9	19	50·7	21	71·6	60·2	57·9	79	114·2	44·5	5·87	20	6·0
Wellington	73·2	15	40·0	23	63·0	55·7	48·6	74	124·0	35·5	4·26	11	5·5
Auckland	73·0	1	43·5	23	65·3	53·4	51·7	76	131·0	40·0	3·20	12	5·0
Jamaica, Negril Point	86·7	18	67·3	3	85·2	71·8	72·0	78	...	...	2·26	10	...
Trinidad	90·0	sev.	61·0	10	89·1	69·4	70·2	73	162·0	62·0	1·79	7	—
Grenada	89·4	1	71·2	23	83·6	73·9	70·8	75	150·0	...	2·95	15	3·7
Toronto	67·0	29	24·0	17	51·1	33·2	30·8	66	77·0	17·5	1·43	9	5·8
Fredericton	65·7	26	20·1	2	52·8	29·7	21·5	43	...	...	1·24	3	5·5
Winnipeg	78·6	26	12·0	12	49·7	27·0	...	...	...	...	·25	2	4·4
Victoria, B.C.	71·0	23	34·7	8	57·5	43·1	...	...	...	...	·21	4	5·6
Dawson	52·8	29	8·8	3	45·0	21·7	...	...	...	...	·94	4	2·2

a and 15, 17, 22.

Cape Town.—The rainfall was the lowest of any April and 1·88 in. below the average of 63 years.

Mauritius.—Mean temp. of air equal to, dew point 0°·1 above, and R 3·12 in. below, averages. Mean hourly velocity of wind 10·7 miles, or 0·2 above average.

MADRAS.—Persistently low temperature. Bright sunshine 231·6 hours.

KODAIKANAL.—Bright sunshine 164 hours. T and L on 26 days.

COLOMBO.—Mean temp. of air 81°·9 or 0°·6 below, of dew point equal to, and R 4·67 in. below, average. Mean hourly velocity of wind 6·8 miles, prevailing direction S.W. T and L on 5 days; L on 17th.

HONGKONG.—Mean temp. of air 67°·8. Mean direction of wind E.; mean hourly velocity 15·1 miles. Bright sunshine 100·7 hours.

Adelaide.—Mean temp. of air 64°·6 or 1°·2 above, R 1·82 in. above, averages.

Sydney.—Mean temp. of air 1°·3 above, humidity 1·1 above, and R ·24 in. above, averages.

Wellington.—Mean temp. of air 0°·1 above, and R ·45 in. above, averages.

TRINIDAD.—Rainfall ·33 in. below 40 years' average.

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THE BRITISH ASSOCIATION IN SOUTH AFRICA.

[SECOND ARTICLE.]

Our previous report gave an outline of the voyage of the British Association to Capetown and of the scientific meetings held there so far as these were concerned with meteorological matters.

On August 18th and 19th the party set out for Natal, one group making the long railway journey of 930 miles to Johannesburg and 380 miles thence to Durban, but the great majority going by sea direct from port to port, a distance of 900 miles. The weather was remarkably fine, and the sea on the Agulhas Bank for once belied its reputation, for there was no motion to disturb the most susceptible. The *Saxon* and *Durham Castle* entered the harbour of Durban on the morning of August 22nd. In the afternoon one of the very few interludes of bad weather occurred in the shape of a severe thunderstorm, which spoiled a garden-party given to the visitors by the Mayor, although it did not damp the generous hospitality of the people of Durban. On the 23rd an opportunity was offered of seeing the coast scenery south of Durban in an excursion by rail to Lower Umkomaas, where the beach of white sand and black rocks was being lashed with the surf raised by the fresh South-East Trade. The next two days were spent in Pietermaritzburg, the capital of Natal, where the display of well-organized hospitality was, if possible, greater than ever, and two days more led the party through the scene of the battlefields about Colenso and Ladysmith.

Johannesburg was reached on the morning of August 28th, and that marvellous city provided at least two surprises—one, that the plague of dust was worse than had been anticipated; the other, that this town of fifteen years' growth was not a crowd of mean houses on the bare veld, but a place of stately buildings and handsome suburbs, shaded by the quick-growing gum trees. Here the Association resumed its official functions and the second half of the sectional meetings took place. The attendance was rarely large, but there were several papers of real importance, and meteorology and allied branches of knowledge were represented by the following:—

AUGUST 29th. Tuesday.
Sir Colin Scott Moncrieff—*Presidential Address [on Irrigation]*. (Section G.)

AUGUST 30th. Wednesday.
Prof. J. Milne—*Report of the Seismological Committee*, and *Recent Advance in Seismology*. (Section A.)
Report of Kites Committee. (Section A.)
Report of Ben Nevis Committee. (Section A.)
Report of Falmouth Observatory Committee. (Section A.)
R. F. Rendall—*Meteorological Notes from the Natal Observatory*. (Section A.)
C. D. E. Braine—*Notes on Irrigation in South Africa*. (Section E.)
J. Burtt-Davy—*Life-Zones of the Transvaal, their Climate and Crops*. (Section K.)

SEPTEMBER 1st. Friday.
H. Ingle—*Pretoria Rain and its Content of Combined Nitrogen*. (Section B.)
A. J. Herbertson and P. C. Waite—*A New Rainfall Map of Africa*. (Section E.)
C. D. E. Braine—*Irrigation in South Africa*. (Section G.)

No papers were read on Thursday, August 31st, that day being occupied by a visit to Pretoria and the Premier Diamond Mines, at which the largest diamond in the world had recently been discovered.

Mr. R. T. A. Innes, the Director of the Transvaal Meteorological Service, threw his new observatory open to members interested in meteorology and took much trouble in ensuring that everyone should see everything that could be of interest. The observatory is a substantial stone building of one storey on the top of a steep rocky hill in the northern suburbs, too steep and wind swept to be suited for all the purposes of a meteorological station, but the grounds run down to the level on the northern side and an enclosure there contains certain supplementary instruments, including a rain gauge and earth thermometers. The observatory itself is admirably equipped with self-registering instruments of the finest description, and a special feature is a large louvred shed in which thermometers, thermographs and hygrographs are exposed conveniently on tables "in the shade." An evaporation tank has been set up and its readings are likely to prove remarkable on account of the high wind and extremely dry air. As few heights above sea-level have been accurately determined, it is impossible to reduce barometer readings throughout the colony to sea-level. Still serviceable synoptic charts are drawn indicating, not absolute height, but differences from previous readings at the various stations.

The concluding meetings of the Association took place at Johannesburg on the afternoon of September 1st, and after resolutions of thanks for the unprecedented kindness of the welcome afforded it,

the Association resolved itself into its constituent units. South African hospitality, however, did not allow the members to disperse in the usual way, for all those from over sea, with a very few exceptions, were privileged to take part in a unique journey throughout the interior of South Africa in four special trains excellently equipped nnd perfectly managed, the same, in fact, as the party had already travelled in from Durban.

The first stopping place was Bloemfontein, the prettily-wooded capital of Orange River Colony, in the midst of a bare brown veld, showing the full effect of the end of the dry season, and traversed by an empty water-course which in the previous year had risen in flood and wrecked a considerable part of the town.

Mr. James Lyle, of Grey's College, has charge of the meteorological work of the colony, but although there are numerous stations at work, there is no central office or fully equipped observatory specially devoted to the purpose. A new site has been chosen for Grey's College on the veld beyond the town and there a convenient position will be available for giving an excellent exposure.

All day on September 4th was occupied by the journey southward to the Orange River through the dry veld covered with burnt-up grass and low shrubs, but only wanting irrigation to become extremely fertile. At night the trains passed into Cape Colony and turned northward again toward Kimberley, crossing the Modder river in the early morning and reaching the city of diamonds (and dust) in the forenoon. The night before, like several other nights on the high veld, had produced fine displays of sheet lightning in different parts of the horizon, but thunder was not heard and there was no rain. Indeed, the weather throughout the inland journey was intensely dry and one's hair crackled with electricity when being brushed, while once or twice the crepitations from a silk tie hastily drawn off a flannel shirt could be heard a few feet away.

It was one of the chief pleasures of the visit to Kimberley to see Mr. J. R. Sutton at his observatory in the pretty suburb of Kenilworth. Part of the cost of the shelters and instruments was borne by the De Beers Company, but Mr. Sutton, ably seconded by Mrs. Sutton, takes all the observations without any paid assistance in the intervals of a busy business life. The meteorological equipment is remarkably complete and, in addition to the routine, much experimental work has been carried on, the best we believe that has yet been turned out in any part of Africa. The Cape Meteorological Commission is unhappily very poor, but the duty lies upon it to see that this important station has some surer guarantee of permanence than the unsparing efforts of one man. In addition to meteorology, Mr. Sutton has a telescope for astronomical work and a seismograph for observing Earth movements.

Onward from Kimberley we travelled northward for 715 miles over the dry veld, on which the grass gave place more and more to low thorny shrubs and then to thin forest, with the green leaves

breaking out freshly in advance of the rains, until, on the morning of September 9th, we reached Bulawayo. Everything in this remarkable town was a surprise, and none greater than to find the meteorological station kept up by Father Goetz, S.J., one of the many Roman Catholic clergy engaged in educational work in South Africa. Of this we shall have something to say next month.

After visiting the impressive solitude of the Matopo Hills and seeing the majestic simplicity of the tomb of Cecil Rhodes, the party resumed its northward journey across a stretch of forest country, where the station houses are strongly palisaded against lions and other wild beasts. The trains drew up before daylight on the 12th, within hearing of the Victoria Falls. It was the end of the dry season and the water in the river was at its lowest; on this account the scenery of the rock gorges could be fully seen, not being lost, as when the river is higher, in clouds of spray. Low water as it was, the falls rose superior to description. It is enough to remind the reader that the Zambesi, flowing along level with the flat country in a stream a mile wide from bank to bank in a course so tranquil that canoes can ply to within a few yards of the edge, drops suddenly into a chasm in the black basalt rocks, nearly 400 feet deep and varying from 100 to 240 feet across. From this chasm the only escape is a narrow zig-zag gorge in some places not more than 100 feet wide, and through it the river rushes, while over it a single steel arch carries the Cape to Cairo railway into Central Africa.

On the afternoon of September 13th the trains left the falls, and travelling all night in comfortable sleeping cars, the party spent the greater part of each day in seeing a fresh town and receiving new hospitality—at Bulawayo on the 14th, at Salisbury on the 15th, at Umtali on the 16th, and then, entering Portuguese territory, at Beira on the 17th. At each of these places we visited an efficient meteorological station, and were able to see something of the peculiar conditions which sometimes require special modifications of exposure or protection. At Bulawayo on September 14th the dry bulb temperature in the shade was 85°, the wet bulb only 55°, a depression of 30 degrees, showing an amazingly low relative humidity. Such an observation gives point to the remark of Professor C. V. Boys, in his lecture at Capetown, to the effect that in the interior of South Africa water evaporates as rapidly as alcohol does at home.

At the risk of being tedious we must reiterate our gratitude to the countless friends who smoothed the way of the pilgrims of science at every step, and most of all to the ladies of the smallest and the most attractive town that entertained us, Umtali, where we left Rhodesia and British South Africa with a last outburst of that hearty welcome which was a revelation when we first met it at Capetown and always a delight.

For the return journey the Union Castle Company had put one of their steamers, the *Durham Castle*, on the East Coast route as a special favour, and one greatly appreciated. The units of the British Asso-

ciation went on board at Beira, after being entertained by the Portuguese authorities, on the afternoon of September 17th, called at Mozambique on the 19th, and anchored in Kilindini harbour, Mombasa, on the 22nd. The outline of Pemba Island, the meteorology of which has been frequently reported in these pages, was seen afar off, but Mombasa was the first experience of equatorial land. The sun at noon was so nearly vertical that looking down one could see no shadow, and the shadeless sunshine made a wonderful picture in the narrow streets of tall white houses with glimpses of stately cocoa-nut palms tossing in the strong sea-breeze, massive baobabs and deep green mango trees, with the white surf and blue sea behind. The breeze was so fresh that the solar radiation produced no discomfort, and though we were walking about during three of the hottest hours it did not feel by any means so oppressive as a warm August day at home. Those who lived at the place, however, reminded us that a wet day without wind would have produced a very different impression as to warmth.

We sailed on the 23rd and did not anchor again until October 4th at Suez. In the Red Sea we met the usual southerly wind of the southern half, which, thanks to the slow speed of the steamer, was able to overtake and refresh us; and the northern half of the sea brought a strong warm northerly wind, the temperature of which never exceeded 97°, and so, though with a small margin, it had a cooling effect. A delay of a week in consequence of a block in the Suez Canal, permitted of a visit to Cairo to crown this wonderful expedition, and on the 11th we entered the Mediterranean, disembarked at Marseilles on the 17th, and next evening were inspecting the rain gauges at Camden Square.

THE LOW TEMPERATURE OF OCTOBER, 1905.

THE exceptionally low temperatures experienced during the latter half of October, 1905, particularly in the third week, have called forth a considerable amount of comment. So far as we are able to form an opinion from the information at our disposal, the month ranks among the most notable in the last half century for early and protracted frost.

We have made a brief examination of the October record at Camden Square, and the results as to temperature may be conveniently epitomised in the following table, dealing with the month as a whole:—

OCTOBER.	Mean, 1905.	Diff. from aver., 1858-97.	No. of times lower, 1858-04.	Highest 1905.	No. of times lower, 1858-04.	Lowest 1905.	No. of times lower, 1858-04.	No. of days at or below 32°.
	°	°		°		°		
Mean Temperature ...	45·8	—4·0	3	53·8	...	38·4	...	...
Shade Maximum	53·8	—3·7	5	61·0	3	46·9	17	...
,, Minimum	38·7	—4·6	0	52·1	7	27·8	7	5
Minimum on Grass ...	34·0	—5·0	1	48·0	5	23·7	9	13

This shows that the most noteworthy departure from the average was in the case of the minimum on grass, but that the mean shade minimum alone was absolutely unprecedented. The mean minimum on grass was however only lower on one occasion—in October, 1888, with 33°·1. The meaning of this is that although there have often been colder individual days in October than occurred on this occasion, there has never before been an October with so low an average of minimum readings. Of the 13 frosts recorded by the exposed thermometer, 11 occurred on consecutive nights from 16th to 26th.

Almost equally prominent with the low mean minima and prevalence of frost was the persistently low day temperature. The maximum temperature reached 60° on one day only, a quite exceptional record, and there have been but three Octobers in the previous 47 years in which the maximum has not exceeded that of the past month. The mean temperature, as will be seen, was as much as 4°·0 below the average, and it has been lower only three times. Unfortunately details of the mean temperature for individual days throughout the record are not readily accessible, but in the present instance it is interesting to note that the mean temperature rose above the average for the month on 7 days only, and was below that point every day from the 14th onwards.

The areas in which the cold weather was most severely felt were, generally speaking, the southern half of England and the inland counties of Scotland and Ireland. In all of these districts temperatures below 25° in the screen were pretty widely recorded. Readings of 20° or lower occurred at some half-dozen stations in the South of England and Wales, and also at Markree Observatory in Sligo. The lowest figures we can quote with confidence were 16° at Llangammarch Wells, and 17° at Polapit Tamar, near Launceston.

Frosts occurred in the screen on 10 days or more over very much the same areas except in Ireland, where so protracted a frost was confined to the south. As many as 15 frosts were recorded at a considerable number of places in the south Midlands of England and at a few stations in the Lowlands of Scotland. At Swerford, in Oxfordshire, frosts were reported on ten consecutive days from 17th to 26th; at Clonmel, in Tipperary, from 15th to 24th. At Farnham there were eight from 15th to 22nd, and at Epsom and Rendlesham seven consecutive frosts. At Ross, in Herefordshire, grass frosts occurred on 13 consecutive nights, from 16th to 28th, a record which we believe to be unprecedented for October.

PERIODICITY OF RAINFALL.

By Arthur P. Jenkin.

Referring to my letter in the *Meteorological Magazine* for June, 1904, I am now in a position to carry the investigation a stage farther. I have not had access to many rainfall records, but I find that the reversal to which I called attention will carry back the three-year period through the whole series of Greenwich records, as the following table will show, there being seven or eight periods in each series.

Table I.—*Rainfall at Greenwich.*

		in.	in.	in.	in.	in.
Series A	I.	1843...24·47	1846...25·29	1849...23·58	1852...34·01	1855...23·59
	II.	1844...23·20	1847...17·61	1850...19·53	1853...29·99	1856...23·27
	III.	1845...22·34	1848...30·10	1851...23·53	1854...19·01	1857...21·16
	Means...					I. 26·19
						II. 22·72
						III. 23·23
Series B	I.	1858...17·70	1861...20·45	1864...16·38	1867...28·46	1870...18·55
	II.	1859...25·83	1862...26·32	1865...28·70	1868...25·15	1871...22·30
	III.	1860...31·90	1863...19·66	1866...30·72	1869...24·02	1872...30·02
	I.	1873...23·36	1876...24·10			
	II.	1874...19·95	1877...27·28		Means...	I. 21·29
	III.	1875...27·97	1878...28·98			II. 25·07
						III. 27·61
Series C	I.	1879...31·36	1882...25·18	1885...24·00	1888...27·51	1891...25·04
	II.	1880...29·68	1883...21·91	1886...24·21	1889...23·28	1892...22·31
	III.	1881...25·72	1884...18·05	1887...19·86	1890...21·86	1893...20·12
	I.	1894...26·89	1897...22·13	1900...22·31		
	II.	1895...19·73	1898...18·85	1901...20·29	Means...	I. 25·55
	III.	1896...22·42	1899...22·33	1902...19·34		II. 22·53
						III. 21·21

Table II.—*Rainfall at Capetown (in percentages).*

Series A	I.	1845 ... 81	1848 ... 90	1851 ... 79	1854 ... 78
	II.	1846 ... 87	1849 ... 95	1852 ... 90	1855 ... 95
	III.	1847 ... 87	1850 ... 130	1853 ... 82	1856 ... 75
	I.	1857 ... 85	1860 ... 113		
	II.	1858 ... 86	1861 ... 99	Means...	I. 88
	III.	1859 ... 142	1862 ... 124		II. 92
					III. 107
Series B	I.	1863 ... 99	1866 ... 74	1869 ... 125	1872 ... 114
	II.	1864 ... 73	1867 ... 89	1870 ... 109	1873 ... 92
	III.	1865 ... 72	1868 ... 78	1871 ... 78	1874 ... 101
	I.	1875 ... 100	1878 ... 159		
	II.	1876 ... 103	1879 ... 72	Means...	I. 112
	III.	1877 ... 138	1880 ... 69		II. 90
					III. 90
Series C	I.	1881 ... 99	1884 ... 110	1887 ... 89	1890 ... 102
	II.	1882 ... 113	1885 ... 108	1888 ... 140	1891 ... 117
	III.	1883 ... 124	1886 ... 108	1889 ... 120	1892 ... 159
	I.	1893 ... 91	(1896 ... 80)		
	II.	1894 ... 88	(1897 ... 97)	Means...	I. 95
	III.	(1895 ... 92)	(1898 ... 118)		II. 110
					III. 120

The years between brackets are for the Cape Peninsula.

I have also extracted from *Nature*, Vol. **57**, p. 115 and Vol. **71**, p. 7, the records for Capetown or the Cape Peninsula for many years, which show the same result, though the number of periods in a series is here six, and the time of reversal does not coincide with Greenwich, which indeed is not to be expected. These are given in Table II.

If then this reversal is to be recognised, it carries back the three-year period through a great many years and over very widely separated stations. The next step is to suggest some reason for the reversal, which I think is not difficult, for I find if one takes a period of three years and a fraction and converts it into a three-year period, reversal occurs in almost exactly the same way as in actual rainfall figures. For example: if a real period of 3·2 years is plotted and then transformed into a period of 3·0 years, reversal takes place at the end of eight periods, as the following table will show. The resemblance between these figures and those of the Greenwich rainfall is very striking. In plotting it is necessary to assume a basis and a range of variation. I have adopted a mean of 30 inches with a variation of 10 inches in either direction.

TABLE III.—*Result of Transforming an Actual Period of* 3·2 *Years into a Period of* 3·0 *Years. (Mean taken as* 30·0 *in. with a variation of* 10 *up and down).*

		in.	in.	in.	in.	in.	in.	in.	in.
Series A	I.	31·0	33·5	35·8	36·6	36·6	35·8	33·5	31·0
	II.	23·1	23·1	24·2	26·0	28·6	31·0	33·5	35·8
	III.	33·5	31·0	28·5	26·0	24·2	23·1	23·1	24·2
Means...	I.	34·2							
	II.	28·2							
	III.	26·7							
Series B	I.	28·5	26·0	24·2	23·1	23·1	24·2	26·0	28·6
	II.	36·6	36·6	35·8	33·5	31·0	28·5	26·0	24·2
	III.	26·0	28·6	31·0	33·5	35·8	36·6	36·6	35·8
Means...	I.	25·5							
	II.	31·5							
	III.	33·0							

It appears then that the apparent period of three years with reversals is a real period of between *three and four years*, which is just what Sir Norman and Dr. Lockyer have observed in meteorological phenomena in India and other widely separated parts of the Earth, which they connect with the occurrence of solar prominences. The evidence for a period thus seems strong, in spite of the negative results which the French records published in this Magazine for July, 1904, show, for if, as Brückner supposes, there are meteorological zones on the Earth's surface, it might well be that some places would not conform to any general rule, and local conditions, too, have sometimes to be taken into account.

With reference to the period of the Earth's polar motion, referred

to in my letter, it would seem that these very minute changes are of an order of magnitude that might be brought about by widespread barometric changes on the surface of the Earth; for, if my reasoning is correct, the greater equatorial diameter of the Earth forming a belt girdling the globe has, by its additional mass, the effect of steadying the poles. If then we imagine a similar belt placed at an angle of 45° to the equator, the axis of rotation of the Earth would be shifted through an angle of 22° 30′. What then would be required to shift the poles through an angle of 0° 0′ 0″·25, which is the limit of motion? This small angle is 1/324000 of 22° 30′, so that a belt at an angle of 45° of a mass 1/324000 of that at the equator will suffice. The equatorial belt has a thickness of about 70,000 ft. and, supposing the specific gravity to be 2, this will be equal to 140,000 feet of water, or 140,000 inches of mercury, of which half an inch of mercury is 1/280,000, being more than the requisite amount. It may be pointed out, too, that it is not necessary for the belt to be complete as the parts at or near the equator may be ignored. If, then, pressure varies over large areas in a certain way, it is quite possible that changes would be caused in the polar motion, and in fact Mr. Kimura, who called attention to the polar period, suggests the effect of meteorological conditions (*Astronomische Nachrichten*, No. 3932); and to refer again to the work of Sir Norman and Dr. Lockyer (*Nature*, Vol. **70**, p. 177), there seems reason to suppose that some such widespread conditions of pressure may exist.

BOOKS RECEIVED.

Notes on a Daily Weather Chart. By A. S. Helps. [Proc. Cotteswold Nat. Field Club. Vol. XV. Part II. May, 1905.] Gloucester, 1905. Size 10 × 6. Pp. 13.

Koninklijk Nederlandsch Meteorologisch Instituut. No. 96. Observations Néerlandaises pour les Etudes Internationales des Nuages, en 1896-1897. Utrecht, 1904. Size 12½ × 9½. Tables and diagrams.

Koninklijk Nederlandsch Meteorologisch Instituut. Nos. 97 and 98. Jaarboek, 1903. Meteorologie en Aard-Magnetisme. Utrecht, 1905. Size 12½ × 9½, Pp. 246 and 34.

Some Results of the Scottish National Antarctic Expedition. [Including Meteorology by R. C. Mossman.] Edinburgh, 1905. Size 9½ × 6. Pp. 40. Frontispiece and maps.

THE TEN MONTHS' RAINFALL OF 1905.

THE Table of aggregate rainfall for the current year shows that the average of the ten months has been exceeded in the north and west of Scotland, though the excess is slight. In all other parts of the country there is still a deficiency which in two areas at least is somewhat serious. The northern area, in which the rainfall has reached less than 75 per cent. of the average, is a comparatively narrow strip along the east coast from about Hartlepool to near Montrose. The southern area, and apparently the drier, extends from Hull south-westward to beyond Derby. A third, though apparently rather less deficient area, lies in the south-west of England, mainly in Devon, Dorset and Somerset, and in South Wales. The south-east of England has been less affected by the reduction of rainfall than any other part of Great Britain south of the Highlands.

The whole central belt of country from Devonshire north-eastward to Hull and from Hull north-westward to Perthshire has had much less than the average rainfall in 1905, and it is highly improbable that the remaining two months will repair the deficiency there.

In Ireland the deficiency is most marked in the west, but is not so considerable as in Great Britain. Taken as a whole, Scotland shows a general rainfall for the ten months equal to 95 per cent. of the average; England and Wales and Ireland have had about 85 per cent.

So far the year has only had two months which were generally wet, March and June, and from many parts of the country serious complaints have arisen on account of the failure of water supplies.

Although the last three days brought a considerable amount of rain in October, the month as a whole was very dry, and a second dry autumn is a serious menace to water supplies, though it bears the promise of a bountiful harvest next year.

Aggregate of Rainfall for January—October, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	19·14	93	Bolton	33·30	97	Braemar	26·54	92
Tenterden	21·77	97	Wetherby	18·10	80	Aberdeen	23·42	90
Hartley Wintney	19·48	91	Arncliffe	39·50	81	Cawdor	25·27	104
Hitchin	20·08	100	Hull	16·83	76	Invergarry	43·27	109
Winslow	17·08	78	Newcastle	16·53	73	Bendamph	69·10	102
Westley	18·97	91	Seathwaite	91·99	88	Dunrobin	26·12	105
Brundall	19·86	97	Cardiff, Ely	26·43	77	Killarney	35·42	78
Alderbury	21·44	93	Haverfordwest	30·56	82	Waterford	27·24	88
Winterbourne	23·25	77	Gogerddan	35·52	98	Broadford	25·63	95
Torquay	21·48	77	Llandudno	21·78	88	Carlow	23·53	85
Polapit Tamar	25·59	85	Cargen	27·92	82	Dublin	20·48	90
Bath	18·78	75	Lilliesleaf	22·38	84	Mullingar	25·71	87
Stroud, Upfield	21·47	88	Colmonell	30·95	88	Ballinasloe	23·53	79
Woolstaston	22·03	82	Glasgow	22·87	79	Clifden	50·04	79
Bromsgrove	17·10	84	Inveraray	54·11	110	Crossmolina	33·43	86
Boston	18·11	94	Islay, Eallabus	41·38	112	Seaforde	25·77	83
Hodsock Priory	13·92	68	Mull	45·15	101	Londonderry	28·85	88
Derby	14·30	66	Dundee	16·60	71	Omagh	28.84	94

Correspondence.

THUNDERSTORMS.

To the Editor of Symons's Meteorological Magazine.

With reference to the correspondence on this subject which has recently appeared in your pages, I may say that I have, for some considerable time past, been actively engaged in collecting information as to the prevalence of thunderstorms in various parts of the United Kingdom, and that I hope to be able to submit the results of the enquiry to the Royal Meteorological Society in the early part of next year. The period dealt with will be the 25 years ending with 1905.

I have already accumulated and plotted data from a large nnmber of stations, but there are some portions of the country which are at present inadequately represented. These are :—

(*a*) The interior of South Wales—say, Carmarthen or the neighbourhood of Llandilo.
(*b*) Lincoln, Doncaster, or the neighbourhood.
(*c*) Essex—somewhere in the neighbourhood of Colchester.
(*d*) Somersetshire—preferably the Taunton district.
(*e*) The west of Ireland—somewhere in the neighbourhood of Galway or Limerick.
(*f*) The south-east of Ireland—the neighbourhood of Wexford or Waterford.

If any of your readers could supply me with records from any of these districts, or could put me in the way of finding them, I should be extremely obliged. The information required is the number of days in each month of the last 25 years upon which thunderstorms, or thunder only, occurred ; sheet lightning is not included in the enquiry.

It is very desirable that the records should extend uninterruptedly over the full period of 25 years ending with 1905, but for some ill-represented districts a record for the last 20 years would be acceptable, if that is the best that can be obtained. For the purpose of my enquiry it is not proposed to deal with any set of observations extending over a shorter period than 20 years.

FREDK. J. BRODIE.

12, Patten Road, Wandsworth Common, S.W.

THE RAINFALL OF OCTOBER.

The peculiarities of October have been worth recording. The barometer was unusually high up to the 29th, with unusually low readings of the thermometers from the 14th to 28th, and the rainfall amounted only to ·59 in. On the morning of the 29th the barometer had fallen in 24 hours from 30·01 in. to 29·46 in. From that day to

the end of the month I registered 1·28 in. of rain. The barometer continued to fall to 29·01 in. on the 1st, and the rainfall, which resulted from the continuance of the same persistent depression of one inch, amounted to ·74 in. for November 1st and ·09 in. for the 2nd, making a total of 2·11 in. for the six days after a dry spell of twenty-seven days.

T. W. SIDEBOTHAM.

The Bourne Vicarage, Farnham,
3rd November, 1905.

UP to and including the 27th of the month, October had proved remarkably dry here, the total rainfall for the period (9 a.m. Oct. 1st to 9 a.m. Oct. 28th) being only ·43 in.

On the 28th, however, a change set in, and the following falls occurred :—

		For October.
October 28th	·33 in.	= 1·94
,, 29th	·11 ,,	+ ·43
,, 30th	1·30 ,,	
,, 31st	·20 ,,	=2·37 in.
November 1st	·70 ,,	
Total of 5 days	2·64 in.	

D. W. HORNER.

Worthing.

CONTRAST IN TWELVE MONTHS' RAINFALL.

I DON'T know if any of your correspondents have noticed the extraordinary difference in the rainfall in the twelve months from March, 1903, to February, 1904, which was 41·48 in. at this station, and the twelve months immediately following, from March, 1904, to February, 1905, which was 19·16 in., a difference of 22·32 in.

I should think this must be a record difference.

G. B. SHOULTS.

North Finchley, N., Oct. 12th, 1905.

[The contrast pointed out by Mr. Shoults is certainly a striking one, and so far as we can see from a hasty inspection of a limited number of records, few show it to a more marked degree than his. We may quote :—

Station.	Rainfall March—Feb. 1903-4. in.	1904-5. in.	Ratio of 1904-5 to 1903-4. per cent.
North Finchley	41·48	19·16	46
Newbury, Welford Park	47·04	21·78	46
London, Camden Square	40·02	17·88	45
Oxford, Magdalen College	37·67	16·65	44

ED. *S.M.M.*]

COLD SOUTH WINDS.

MR. BACKHOUSE, in his letter in the Magazine for October, dated 3rd inst., refers to the cold winds from the south at Sunderland, and suggests snow as the cause. I may remark that here winds from S. and S.W. are often very cold, even in summer, and that there is very little snow.

C. S. PRINGLE.

Whitekirk, Southbourne, Hants, 19th October.

SOME WEATHER PROBLEMS.

THE present year is probably one of maximum sunspots.

A steamer leaving England for the Cape in the end of July, meets (as you tell us) with "surprisingly cool" weather right through the tropics.

Without affirming a causal nexus between these facts (which is obviously unwarrantable), we may be reminded by them of what is perhaps one of the best ascertained relations concerning "sunspots and weather." Some thirty years ago Köppen found in the tropics, heat with minima, coolness with maxima. And recently, Nordmann, bringing the inquiry up to date, arrived at the same result.

"This shows that the sun is hottest (gives out most heat) about minima," say some. Not necessarily. There is more to be said, apparently, for the sun being hottest about maxima. And those who take this view account for the tropical coolness about maxima by increased evaporation, cloud, &c.

Let us now turn to another set of phenomena. It has been shown by Hann that our weather in western Europe, in the winter half especially, is largely ruled by the condition of a permanent low-pressure system having its centre about Iceland. When this is deep, or intense, our coasts get flushed with south-westerly winds, and we have warmth; in the opposite case, there is cold.

Again, there seems to be a sort of see-saw between this low-pressure system and one of high-pressure over the Azores to the south. When the pressure in the latter goes up, that in the former goes down, and *vice versâ*. The Azores pressure is generally, but not always, higher than that over Iceland.

Now, there is some reason to believe that our temperature in the early months of the year, March especially, varies with the sunspot cycle, in the sense of warmth with maxima. Thus, about maxima (as shown by Flammarion and others), there is a tendency to earlier springs and earlier vegetation. Curves of early and late flowering of certain plants have been shown to be in agreement with the sunspot curve.

Can we, then, find in the table of Iceland pressures recently given by Hann, indications of sunspot influence? I think we can. The pressure in March agrees in its larger waves very fairly with the sunspot curve, in the sense of low pressures with maxima.

The view I would offer for criticism is briefly this : Sun hottest about maxima. More air then drawn in and up at the equatorial furnace. More air carried over and down in anticyclonic systems north and south. Hence (among other things), more air descending in March over the Azores and lower pressures over Iceland. Hence, in our region at maxima, much south-westerly wind, early spring and early vegetation.

There may be difficulties about this view which I have overlooked. The behaviour of polar ice in relation to the sunspot cycle is a subject which seems likely to come into prominence erelong, and one on which we greatly need more light. Have any differences been observed in polar regions between times of maxima and minima of sunspots? Some seasons are very open ; others the opposite. How are these distributed in the eleven years' period?

The low-pressure system over Iceland, when intensified, tends to stimulate the Gulf Stream on the side next us by south and south-westerly winds, and the Labrador Current on the farther side by north and north-easterly winds. In the former case more warm water is carried to northerly regions, affecting, doubtless, the temperature conditions there; and in the latter more ice tends to be carried down to the Newfoundland region to melt in the warm water of the Gulf Stream. This cooled water, if in that portion of the Stream coming to our shores, probably affects our weather for a time; but we need further light on the subject.

A very interesting paper by Dr. Meinardus, dealing with some of these relations, will be found in the September number of the *Meteorologische Zeitschrift*.

ALEX. B. MacDOWALL.

METEOROLOGICAL NEWS AND NOTES.

Dr. W. von Bezold is, we are happy to learn, alive and well. Our note last month was given on the authority of a scientific paper, which had no doubt been misled by a Berlin newspaper, confounding another Herr von Bezold, who died in September, with the distinguished meteorologist. What makes the fact more striking is that almost on the same date the great geographer Baron von Richthofen, died in Berlin seventeen years after having been the victim of a precisely similar mistake.

A Lectureship on Meteorology has been established in the University of Manchester, and Mr. George C. Simpson has been appointed to the post. He is, we believe, the first University lecturer on Meteorology in this country, and the University of Manchester is to be congratulated on taking such an important step forward.

The Anti-Trades, or south-westerly steady breezes blowing above the north-easterly surface trade winds, have been known since

Humboldt's famous observation on the Peak of Tenerife, but there was no direct measurement of the height at which the direction changed, or any demonstration of the permanence of these upper winds until Mr. A. Lawrence Rotch and M. Teisserenc de Bort took the matter up last summer. Their assistants, Messrs. Clayton and Maurice, made a series of kite and *ballon sonde* observations in the Atlantic, during July and August, 1905, and they report that they were able to penetrate the trade winds on many occasions. The north-easterly surface winds reached to heights varying from about 1500 to about 12,000 feet, and in each case the upper wind was found to have a southerly or westerly component.

DR. MAURITS SNELLEN has retired from his position as director of the department of Terrestrial Magnetism and Seismology in the Royal Meteorological Institute of the Netherlands at de Bilt.

SYNOPTIC WEATHER MAPS are now being published by the daily newspapers in Australia, showing the isobars for the whole continent. A series of these charts has reached us from the Meteorological Branch of the Sydney Observatory, and at a later date another specimen has been received from an Adelaide paper. It would appear that the several States of the Commonwealth are collecting data and producing separate maps and forecasts.

FORTNIGHTLY CONFERENCES on meteorological work have been instituted by the Director of the Meteorological Office, mainly for the purpose of affording the staff of the office, meteorological observers, and others interested, an opportunity of discussing published meteorological works, especially those of colonial and foreign meteorologists, in an informal way. At the first meeting on November 6th, Professor Hildebrandsson's report on the International Observations on Clouds was discussed. On Tuesday, November 21st, the subject will be Professor Pettersson's and Mr. Knudsen's Report on the physical work of the International Council for the Study of the Sea. Such meetings should prove useful and help to increase the growing interest in scientific meteorology.

THE ROYAL METEOROLOGICAL SOCIETY'S new scheme for extending public interest in Meteorology, is now in operation. The exhibit of the Society, which consists of a typical climatological station, instruments for the exploration of the upper atmosphere, a large collection of photographs illustrating meteorological phenomena, models, diagrams and charts, has been shown during the past month in connection with the following local societies :—October 11th, at the Walsall Literary Institute, in the New Town Hall, Walsall. October 25th, at the Rochester Naturalists' Club, in the Mathematical School, Rochester. November 3rd—4th, at the Rochdale Literary and Scientific Society, in the Town Hall, Rochdale. At the latter place the local society arranged with the Education Committee for the teachers of the town to visit the exhibit, and have it explained to them. We understand that altogether about 1400 people have inspected the exhibit at the places named above.

RAINFALL AND TEMPERATURE, OCTOBER, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE Max. Deg.	Date.	Min. Deg.	Date
		inches	inches.	in.						
I.	London (Camden Square) ...	1·40	— 1·45	·36	30	14	61·0	9	27·8	22
II.	Tenterden ...	1·88	— 1·72	·88	30	15	58·5	4,9,11	26·0	17
,,	Hartley Wintney ...	1·62	— 1·46	·52	29	11	57·0	4	23·0	17, 2
III.	Hitchin ...	1·49	— 1·23	·51	29	13	58·0	9	26·0	25
,,	Winslow (Addington) ...	1·18	— 1·71	·38	29	13	58·0	8	24·0	22, 2
IV.	Bury St. Edmunds (Westley)	2·05	— ·61	·34	4	19	60·0	9	28·5	17
,,	Brundall ...	4·14	+ 1·16	·48	4	26	58·4	9	28·8	26
V.	Alderbury ...	1·74	— 1·66	·57	31	10	63·0	1, 4	22·0	16
,,	Winterbourne Steepleton ...	2·31	— 2·02	·64	31	14	62·5	9	22·2	17
,,	Torquay (Cary Green) ...	2·30	— 1·79	1·09	31	11	63·1	10	31·2	17
,,	Polapit Tamar [Launceston]	2·58	— 2·39	·58	30	17	63·1	10	17·0	23
,,	Bath ...	1·45	— 1·77	·44	31	12	64·5	9	24·0	17
VI.	Stroud (Upfield) ...	1·90	— 1·20	·54	15	14	60·0	9	28·0	21
,,	Church Stretton (Woolstaston)	1·93	— 2·06	·35	15	14	59·0	9, 10	26·0	19
,,	Bromsgrove (Stoke Reformatory)	·96	— 1·59	·22	31	10	55·0	9	18·0	21
VII.	Boston ...	1·63	— ·99	·38	4	15	64·0	9	27·0	27
,,	Worksop (Hodsock Priory).	1·17	— 1·60	·34	4, 15	13	64·1	9	26·4	17
,,	Derby (Midland Railway)...	1·20	— 1·57	·39	4	16	61·0	9	27·0	14
VIII.	Bolton (The Park) ...	5·06	+ ·34	1·21	14	18	55·6	9	29·1	17
IX.	Wetherby (Ribston Hall) ...	1·70	— 1·48	·50	15	12	...	...	...	...
,,	Arncliffe Vicarage ...	4·44	— 2·11	·87	4	14	...	...	...	...
,,	Hull (Pearson Park) ...	2·00	— 1·26	·48	14	21	63·0	9	30·0	17
X.	Newcastle (Town Moor) ...	3·06	+ ·12	·78	14	23	...	...	...	...
,,	Borrowdale (Seathwaite) ...	12·01	— 1·34	3·45	14	15	58·0	10	25·8	20, 22
XI.	Cardiff (Ely) ...	2·76	— 2·05	·65	31	13	...	...	...	...
,,	Haverfordwest (High St.)..	2·01	— 3·62	·44	29	18	61·6	9	22·2	23
,,	Aberystwyth (Gogerddan)..	3·07	— 2·51	·85	26	10	63·0	9, 10	22·0	22
,,	Llandudno ...	4·10	+ ·02	·78	7	17	58·0	1, 8	31·5	22
XII.	Cargen [Dumfries] ...	2·80	— 1·59	·58	29	11	62·0	9	24·0	17
,,	Lilliesleaf (Riddell) ...	2·28	— ·96	·56	14	17	62·0	9	25·0	17
XIII.	Edinburgh (Royal Observy.)	2·20	...	·71	14	13	60·9	9	31·1	18
XIV.	Colmonell ...	4·89	— ·08	·66	26, 29	15	59·0	9	20·0	19
XV.	Tighnabruaich ...	6·07	+ ·35	1·25	3	15	56·0	9	27·0	17
,,	Mull (Quinish) ...	6·21	+ ·12	·97	28	27	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	1·90	— ·81	·70	31	14	62·1	9	27·0	20
XVII.	Braemar ...	3·85	— ·20	1·03	30	24	62·4	10	24·3	20
,,	Aberdeen (Cranford) ...	3·75	+ ·57	·51	30	25	60·0	9, 10	32·0	13
,,	Cawdor (Budgate) ...	4·18	+ 1·33	1·08	31	23	...	...	...	...
XVIII.	Invergarry ...	3·84	— 1·70	1·21	19	8	...	...	...	...
,,	Bendamph ...	9·76	— ·22	1·80	7	28	...	...	...	...
XIX.	Dunrobin Castle ...	3·86	+ ·54	·94	30	19	58·0	10	30·0	28
,,	Castletown ...	5·77	...	·97	30	30	57·0	10	29·0	18, 19
XX.	Killarney ...	2·97	— 3·08	·81	31	14	69·5	10	27·0	18
,,	Waterford (Brook Lodge)...	·74	— 3·26	·27	27	9	67·0	9	22·5	18
,,	Broadford (Hurdlestown) ...	1·93	— 1·19	·68	29	14	56·0	3, 10	27·0	19, 20
XXI.	Carlow (Browne's Hill) ...	1·08	— 2·40	·25	29	12	...	...	...	...
,,	Dublin (Fitz William Square)	1·20	— 1·88	·37	2	16	62·9	9	29·0	21
XXII.	Ballinasloe ...	1·50	— 1·95	·40	29	17	66·0	12	...	...
,,	Clifden (Kylemore House)..	4·53	— 3·40	·75	26	13	...	...	...	...
XXIII.	Seaforde ...	1·59	— 2·23	·51	29	10	61·0	8	29·0	18
,,	Londonderry (Creggan Res.)	2·67	— 1·78	·54	14	22	...	...	...	...
,,	Omagh (Edenfel) ...	2·10	— 1·62	·31	3, 28	20	62·0	9	22·0	19

+ Shows that the fall was above the average; — that it was below it. a and 20, 21, 22. b—and 18, 1
c—and 15, 17, 18. d—and 19, 21.

SUPPLEMENTARY RAINFALL, OCTOBER, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·89	XI.	New Radnor, Ednol	2·55
,,	Ramsgate, West Cliff	1·80	,,	Rhayader, Nantgwillt	4·75
,,	Hailsham	2·65	,,	Lake Vyrnwy	3·73
,,	Crowborough	2·28	,,	Ruthin, Plâs Dráw	2·83
,,	Osborne	2·43	,,	Criccieth, Talarvor	3·96
,,	Emsworth, Redlands	1·57	,,	Anglesey, Lligwy	4·04
,,	Alton, Ashdell	2·38	,,	Douglas, Woodville	3·61
,,	Newbury, Welford Park	2·42	XII.	Stoneykirk, Ardwell House	3·08
III.	Harrow Weald	1·28	,,	Dalry, Old Garroch	4·81
,,	Oxford, Magdalen College	1·28	,,	Langholm, Drove Road	3·43
,,	Banbury, Bloxham Grove	1·04	,,	Moniaive, Maxwelton House	3·59
,,	Pitsford, Sedgebrook	·95	XIII.	N. Esk Reservoir [Penicuick]	2·25
,,	Huntingdon, Brampton	1·18	XIV.	Maybole, Knockdon Farm	3·37
,,	Wisbech, Bank House	1·41	,,	Glasgow, Queen's Park	2·61
IV.	Southend	1·00	,,	Campbeltown, Redknowe	5·74
,,	Colchester, Lexden	·99	XV.	Inveraray, Newtown	6·30
,,	Saffron Walden, Newport	1·29	,,	Ballachulish House	5·13
,,	Rendlesham Hall	1·98	,,	Islay, Eallabus	6·01
,,	Swaffham	3·02	XVI.	Dollar	3·43
,,	Blakeney	3·18	,,	Loch Leven Sluices	1·99
V.	Bishops Cannings	1·78	,,	Balquhidder, Stronvar	4·30
,,	Ashburton, Druid House	2·45	,,	Coupar Angus Station	1·86
,,	Okehampton, Oaklands	3·47	,,	Blair Atholl	2·44
,,	Hartland Abbey	1·94	,,	Montrose, Sunnyside	1·77
,,	Lynmouth, Rock House	3·33	XVII.	Alford, Lynturk Manse	4·78
,,	Probus, Lamellyn	2·07	,,	Keith	7·59
,,	Wellington, The Avenue	1·96	XVIII.	N. Uist, Lochmaddy	4·09
,,	North Cadbury Rectory	2·01	,,	Aviemore, Alvey Manse	4·18
VI.	Clifton, Pembroke Road	2·03	,,	Loch Ness, Drumnadrochit.	3·68
,,	Moreton-in-Marsh, Longboro'	1·59	,,	Glencarron	8·77
,,	Ross, The Graig	1·57	,,	Fearn, Lower Pitkerrie	2·97
,,	Shifnal, Hatton Grange	1·24	XIX.	Invershin	4·22
,,	Wem Rectory	1·28	,,	Altnaharra	4·35
,,	Cheadle, The Heath House.	2·38	,,	Bettyhill	6·35
,,	Coventry, Kingswood	1·33	,,	Watten	4·67
VII.	Market Overton	1·05	XX.	Cork	·92
,,	Market Rasen	2·44	,,	Darrynane Abbey	2·13
,,	Bawtry, Hesley Hall	1·01	,,	Glenam [Clonmel]	·90
VIII.	Neston, Hinderton	1·87	,,	Ballingarry, Gurteen	1·49
,,	Southport, Hesketh Park	2·87	,,	Miltown Malbay	1·85
,,	Chatburn, Middlewood	3·81	XXI.	Gorey, Courtown House	·86
,,	Cartmel, Flookburgh	3·62	,,	Moynalty, Westland	1·50
IX.	Langsett Moor, Up. Midhope	3·75	,,	Athlone, Twyford	1·39
,,	Scalby, Silverdale	4·48	,,	Mullingar, Belvedere	1·63
,,	Ingleby Greenhow	4·12	XXII.	Woodlawn	2·04
,,	Middleton, Mickleton	1·67	,,	Westport, Murrisk Abbey	2·76
X.	Beltingham	2·47	,,	Crossmolina, Enniscoe	3·00
,,	Font Reservoir, Fallowlees.	3·71	,,	Collooney, Markree Obsy	3·53
,,	Ilderton, Lilburn Cottage	3·98	XXIII.	Enniskillen, Portora	2·14
,,	Keswick, The Bank	4·31	,,	Warrenpoint	1·08
XI.	Llanfrechfa Grange	2·55	,,	Banbridge, Milltown	1·17
,,	Treherbert, Tyn-y-waun	4·43	,,	Belfast, Springfield	1·65
,,	Carmarthen, Friary	2·71	,,	Bushmills, Dundarave	3·44
,,	Castle Malgwyn	3·27	,,	Stewartstown	1·59
,,	Plynlimon	8·95	,,	Killybegs	3·16
,,	Tallyllyn	2·30	,,	Horn Head	3·74

METEOROLOGICAL NOTES ON OCTOBER, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The weather was fine as a rule, with many exceptionally beautiful days particularly in the middle. The first half was rather sunless and the latter half decidedly cold,‡ with many frosty nights. Mean temp. 45°·8, or 4°·0 below the average. Duration of sunshine 93·9* hours, and of R 16·3 hours.

ABINGER HALL.—Cold and frosty, with N.W. to N.E. winds for the greater part. The last week was showery and warmer, with strong S. and S.W. winds.

TENTERDEN.—Damp at first, but deficient R till the last three days. Very cold from 17th to 26th, but with sunny days generally. Autumn tints and the fall of the leaf began unusually early. Duration of sunshine 113·2* hours. TS on 30th.

CROWBOROUGH.—Cold but fine, with several brilliant days. Nearly all the R fell during the last week, when the weather became milder. R 1·91 in. below the average. Mean temp. 44°·4. TS with much L and H on 30th.

HARTLEY WINTNEY.—The chief feature was the prolonged period of cold, with persistent N. wind, cloudy days, and absence of fog and gales. The few closing days robbed the month of its distinction as a phenomenally dry one. Ozone occurred on 22 days with a mean of 4·8.

PITSFORD.—Altogether cold and uncomfortable, although many days were bright. R 2·13 in. below the average. Mean temp. 44°·3.

BURY ST. EDMUNDS.—Cold, with R in small quantities on 19 days. Ponds and rivers were nearly dry and deep wells were getting low.

BRUNDALL.—An ungenial month. The mean temp., 44°·8, was the lowest for October since the register was commenced in 1883. The R was excessive, being caused by shallow depressions passing in a southerly direction and affecting the E. coast while the westerly anticyclone kept the weather dry in all places to the W.

TORQUAY.—Mean temp. 49°·3, or 2°·7 below the average. Duration of sunshine 133·0* hours, or 20·4 hours above the average. Mean amount of ozone 4·0.

NORTH CADBURY.—Remarkable for calmness, sunshine, dryness of air, and temp. in every respect much below the normal. It was, however, a pleasant and healthy month, with roads clean and soil in magnificent working order. There was a complete change on 28th to S.W. winds, normal warmth, low pressure and much R.

CLIFTON.—The first week was showery, then fine and dry with occasional slight R till 25th, with northerly winds, low temp. and night frosts. The last few days were mild and rainy with S.W. winds. R little more than half the average.

ROSS.—Unsettled, with frequent light R till 7th, then cold but very dry till 28th. The last three days were wet. There was continuous ground frost every night from 16th to 28th, an unprecedented length of time.

BOLTON.—A cold but dry month. Mean temp. 43°·9, or 3°·0 below the average. The R was above the average, but fell mostly in large amounts, leaving the air remarkably dry. Duration of sunshine 56·7* hours, or 3·8 hours below the average.

SOUTHPORT.—Normal during the first fortnight and towards the close, but remarkably cold from 16th to 26th, under the influence of dry N.N.E. winds. It was exceptionally sunny during the cold period. Mean temp. 3°·3 below the average. Duration of sunshine 23* hours above the average. Total

* Campbell-Stokes. † Jordan. ‡ See p. 177

R 1·07 in. below the average. Mean underground water level lower than in any previous October since the record commenced.

BELTINGHAM.—Very cold nights from 15th to 22nd, especially from 16th to 19th, when the temp. fell to 10° below freezing each night. S on 15th.

LILBURN COTTAGE.—From 1st to 14th seasonable weather prevailed, but on 15th a heavy S storm came on at 3.30 p.m. and lasted for two hours. Heavy S again on 18th. The Cheviots were covered from 15th to the end. R much above the average; very low temp. from the middle till the end.

LLANFRECHFA GRANGE.—Fine with moderate R, but unusually low temp. from 16th to 26th. There was, however, a good deal of warm sunshine.

CARMARTHEN.—Remarkably fine and dry, but cold with morning frosts. Favourable for working on the land, but water supplies getting low.

HAVERFORDWEST.—The coldest and driest October for 56 years, the air being generally dry and keen. Low grass minimum temp. from 16th to 29th. Broken weather from 26th to the end. Duration of sunshine 118·0* hours.

DOUGLAS.—Cold, but with excess of sunshine. The period from 17th to 25th was brilliantly fine. The first and last weeks were wet, the bar. falling to 29·04 in. on 30th, when it was mild and stormy. L on 29th.

SCOTLAND.

CARGEN.—Abnormally cold and dry for the first three weeks. Severe frost from 16th to 25th played serious havoc in the garden and caused an unusually early fall of the leaf.

LANGHOLM.—R 1·47 in. below the average of 29 years. Severe night frost with sunny days from 15th to 25th.

COUPAR ANGUS.—Mean temp. 43°·2, or 1°·4 below the average. Bright sunshine and little R till 15th, followed by severe morning frosts. R again below the average, being with the exception of March the eleventh month in succession with a deficiency.

DRUMNADROCHIT.—R ·19 in., and rainy days 3·5, greater than the average of 19 years. The chief feature was the unusual cold, culminating in the sharp frosts of 14th to 18th, when the exposed iron pipes for the main water supply were frozen.

BETTYHILL.—There was scarcely a whole dry day throughout the month, and the R was unusually heavy. On two occasions more than 1·25 in. fell in 24 hours. There were frequent high winds.

IRELAND.

CORK.—Remarkable both for low temp. and small R, the min. temp. on 18th and 21st, 26°, being the lowest in October for 23 years. The R was the smallest since 1879.

DARRYNANE.—The driest October in 25 years except in 1899, the R being only 39 per cent. of the average. Of the total, 1·44 in. fell in the last six days. It was a cold month, with constant E. wind for the first three weeks.

WATERFORD.—The driest October for 56 years, and with mean temp. much below the average.

DUBLIN.—Generally favourable with a small but frequent R, and almost continuous low temp. after 13th. Mean temp. 47°·2, or 2°·2 below the average of 30 years. Duration of sunshine 110·7* hours. Prevailing winds N.W. and W. Only one stormy day.

MARKREE OBSERVATORY.—On the first few days R fell heavily at times, with fogs and rather low temp. Frost set in on 17th, remaining for a week, being severe on a few nights. Showery towards the end and cold at times.

OMAGH.—A month of chiefly polar and easterly winds, deficient R, and, during the third week, the lowest mean and actual temp. ever registered in October. It was, notwithstanding, a favourable month for farming operations.

Climatological Table for the British Empire, May, 1905.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	83·2	29	35·1	23	66·1	44·5	44·0	68	128·1	28·4	1·18	9	5·3
Malta	89·5	23	53·1	3	74·1	58·9	56·6	76	133·8	48·0	·59	5	2·8
Lagos	92·0	5	72·5	25	87·9	75·7	74·4	72	143·0	65·0	7·15	16	6·6
Cape Town	79·6	5	41·1	21	65·6	49·4	51·3	82	...	...	4·53	17	5·1
Durban, Natal	83·3	2	49·9	29	76·8	58·6	...	...	137·2	...	·81	5	3·3
Johannesburg	71·2	8	30·0	28	63·9	46·0	39·8	64	129·5	29·2	·35	3	1·4
Mauritius	81·7	14	60·6	16	78·6	66·6	65·8		40·2	52·2	3·35	20	6·7
Calcutta	100·7	23	67·4	10	92·0	76·8	75·6	78	155·8	65·9	10·01	8	5·4
Bombay	92·1	16	77·2	1	90·7	80·5	76·7		141·0	71·6	·09	0	3·0
Madras	107·9	29	76·1	4	96·8	80·4	74·4	70	144·9	74·1	·06	1	3·8
Kodaikanal	74·7	5	50·9	28	69·9	54·8	52·4	74	149·0	43·7	6·52	13	5·1
Colombo, Ceylon	89·4	5	73·8	24	87·2	77·6	75·5	84	15·4	73·0	13·54	26	7·0
Hongkong	89·4	20	68·4	4	83·0	74·3	72·1	82	148·5	...	6·83	11	6·6
Melbourne	83·7	7	38·4	21	65·7	47·6	48·0	79	131·2	32·0	2·97	10	6·5
Adelaide	85·2	6	40·8	10	67·8	51·1	47·2	66	133·8	36·3	3·58	11	5·4
Coolgardie	86·2	3	38·0	7	68·0	49·6	47·7	66	146·9	35·0	1·63	13	5·6
Sydney	76·1	8	47·7	30	65·8	53·3	51·1	82	106·9	39·7	5·20	26	5·4
Wellington	65·5	14	43·0	15	58·6	48·2	46·0	77	111·0	33·0	5·78	15	5·9
Auckland	68·0	4	45·0	18	61·9	50·7	50·0	80	126·0	42·0	2·29	11	5·4
Jamaica, Negril Point	87·5	27	69·0	8	85·8	72·2	72·9	80	...	...	9·80	19	...
Trinidad	91·0	1,2*a*	68·0	30	87·6	71·0	71·9	76	164·0	66·9	4·34	13	...
Grenada	86·0	14	72·0	18	83·9	74·7	69·6	73	144·8	...	4·61	17	3·7
Toronto	75·6	25	31·9	1	62·5	42·9	45·8	71	89·5	26·6	3·23	15	5·6
Fredericton	76·8	26	23·9	13	61·6	38·3	33·6	49	...	...	1·94	11	5·2
Winnipeg	80·5	31	27·0	6	62·5	38·3	...	...	...	...	3·35	11	5·8
Victoria, B.C.	72·2	26	37·8	18	59·2	45·9	...	...	...	...	2·83	15	6·2
Dawson	78·5	25	25·5	2	59·0	38·7	...	...	...	...	·97	4	4·1
Lagos (January)	92·0	7	71·0	15	88·8	75·6	70·2	75	139·0	65·0	·04	1	2·5
Lagos (February)	91·0	7,9,16	69·0	6	89·1	74·5	70·2	68	139·0	61·5	1·04	1	2·8

a and 15.

MALTA.—Mean temp. of air 64·8, or 0·6 above average. Mean temp. of sea 64·7. Mean hourly velocity of wind 8·8 miles, or 1·2 below average.

Mauritius.—Mean temp. of air 0·2 below, dew point 0·5 above, and R ·34 in. below, averages. Mean hourly velocity of wind 9·6 miles, or 1·7 below average.

MADRAS.—Bright sunshine 211·6 hours. Dust storm on 15th.

KODAIKANAL.—Bright sunshine 206 hours. Frequent T88.

COLOMBO.—Mean temp. of air 81·8 or 0·6 below, of dew point 0·2 above, and R 1·49 in. above average. Mean hourly velocity of wind 9·4 miles; prevailing direction S.W.

HONGKONG.—Mean temp. of air 78·1. Mean direction of wind E.S.E.; mean hourly velocity 10·1 miles. Bright sunshine 212·0 hours.

Adelaide.—Mean temp. of air 1·8 above, R ·83 in. above, averages.

Sydney.—Mean temp. of air 1·2, and humidity 5·8 above averages.

Wellington.—Mean temp. of air 0·4 above, and R 1·19 in. above, averages.

TRINIDAD.—Rainfall ·41 in. above 40 years' average.

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Obituary.

PIETRO TACCHINI.

1838—1905.

Professor Pietro Tacchini, until recently Director of the Astronomical Observatory and of the Central Meteorological and Geodynamical Institute in Rome, died at his estate at Spilamberto, near Modena, on March 24th. Although meteorology claimed only a share of the attention of the distinguished Italian man of science, the organization of the Italian Meteorological Service owed much of its efficiency to his efforts. Probably, Professor Tacchini will be remembered best for his researches on the physical constitution of the sun, especially his spectroscopic studies of sunspots and prominences. He did scarcely less for the study of earthquakes, having founded, and long presided over, the Italian Seismological Society. Along with Dr. Billwiller, Professor Tacchini was elected an honorary member of the Royal Meteorological Society on May 18th, 1892.

ROBERT BILLWILLER.

2nd August, 1849—14th August, 1905.

Dr. Robert Billwiller, the eminent Swiss meteorologist, died in the fifty-seventh year of his age. Born at St. Gallen, in Switzerland, he studied first in Zurich, and afterwards in the Universities of Göttingen and Leipzig. At that time his attention was given mainly to astronomy and mathematics, but in 1872 he was appointed to a meteorological assistantship in the Federal Observatory at Zurich, of which Dr. Rudolph Wolf was then Director. In less than ten years Billwiller had worked up the small meteorological department of the Observatory into a Central Meteorological Institute for Switzerland, of which he was appointed Director in 1881. A few years later a wealthy citizen of Winterthur left a legacy of £5000 to the Institute, thereby greatly extending its usefulness.

Altogether, the Swiss system included 118 complete meteorological stations, and 270 additional rainfall stations. Amongst these is the first-order station established on the summit of the Säntis, in 1882, by private initiative, but, with a happier fate than befel its slightly younger sister on Ben Nevis, it was taken over by the Government in 1885. Billwiller's work on mountain and on föhn winds were important contributions to meteorology. He was a man of wide culture, known and honoured far beyond his native land. On May 18th, 1892, he was elected an honorary member of the Royal Meteorological Society.

THE RAINFALL OF THE ELEVEN MONTHS.

Aggregate of Rainfall for January—November, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	22·22	96	Bolton	38·42	100	Braemar	33·41	101
Tenterden	26·01	102	Wetherby.....	22·34	90	Aberdeen	30·25	102
Hartley Wintney	22·67	92	Arncliffe	46·89	86	Cawdor	28·98	108
Hitchin	22·48	99	Hull	19·78	80	Invergarry ...	49·49	100
Winslow	20·29	83	Newcastle.....	21·03	83	Bendamph ...	77·17	100
Westley.....	21·13	91	Seathwaite ...	105·91	90	Dunrobin	30·13	107
Brundall	21·81	94	Cardiff, Ely ...	30·65	80	Killarney ...	40·99	80
Alderbury	25·00	95	Haverfordwest	37·49	88	Waterford ...	31·62	90
Winterbourne ...	29·95	86	Gogerddan ...	39·59	97	Broadford.....	28·60	95
Torquay	26·87	85	Llandudno ...	25·64	91	Carlow	26·87	87
Polapit Tamar ...	31·31	91	Cargen	32·67	84	Dublin	24·03	95
Bath	21·86	78	Lilliesleaf.....	25·76	86	Mullingar.....	29·12	88
Stroud, Upfield...	25·24	92	Colmonell.....	37·63	94	Ballinasloe ...	26·03	78
Woolstaston	25·40	84	Glasgow	26·24	81	Clifden	57·16	80
Bromsgrove	19·39	86	Inveraray	60·87	110	Crossmolina ...	41·95	94
Boston	20·56	96	Islay, Eallabus	47·51	113	Seaforde	30·81	88
Hodsock Priory..	16·48	73	Mull	50·95	100	Londonderry..	33·70	91
Derby.....	16·80	70	Dundee	20·95	80	Omagh	32·70	96

The rainfall of November was above the average at most stations, but not to a marked degree except in the north-east of Scotland. The result was to raise the aggregate general rainfall from 85, 95 and 85 per cent., respectively, for England and Wales, Scotland and Ireland, at the end of October, to 88·5, 99 and 89 per cent. at the end of November. The regional distribution remained almost unchanged; rather more of Scotland had received an average fall, the only conspicuously dry part being in the neighbourhood of Dundee. The relatively dry part of England still stretched from the Humber to the Severn, but the only part of the British Isles in which less than 75 per cent. of the average of the 11 months' rain had fallen, was a comparatively small patch round Derby.

ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of this Society for the present session was held on Wednesday evening, November 15th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Sir John W. Moore, M.D., communicated an interesting paper on "The Rainstorm of August 24—26, 1905, in Counties Dublin and Wicklow," which in the absence of the author was read by the Secretary. The atmospheric disturbance which caused the torrential rainfall was near the shores of Kerry on the 24th, and the next morning it was near the Scilly Islands. Thence it travelled slowly northward up St. George's Channel, its centre passing near Dublin early on the morning of the 26th. At this time the system suddenly changed its course, crossing the Channel eastward to Wales, and finally passing over central England and out to sea at the mouth of the Humber in a north-easterly direction. It appears that the rainfall on the 25th exceeded three inches at all stations in the Counties Dublin and Wicklow, while it rose above four inches and even five inches at stations near the Dublin and Wicklow mountains. The author is of opinion that this remarkable downpour was brought about by the co-operation of four factors: (1) A chill antecedent to the arrival of the rain-bearing depression; (2) the slow progress of the depression; (3) the fact that the Counties Wicklow and Dublin lay to the westward of the cyclonic centre and so got its north-easterly and northerly winds; and (4) the physical configuration of those counties and their coast line. As the result of this remarkable rainstorm a destructive flood occurred over the low-lying parts of the Bray Urban District near the mouth of the Bray River. At Little Bray the water rose to a height of 4 feet in the streets, flooding houses, destroying domestic animals and fowls, wrecking furniture, and covering floors, yards and gardens with a thick alluvial deposit.

Dr. H. R. Mill said that as a result of discussing heavy cyclonic rains he had found they occurred nine times out of ten on the left of the track of the depression, and this instance was a confirmation of the rule. It was very desirable to have as close a network of rain gauges as possible all over the country, for stations half-a-mile apart or less might define the boundary of a heavy fall and be extremely helpful in the elucidation of such phenomena as the one under discussion.

Dr. R. H. Scott remarked that he had visited the district affected by the rainstorm soon after the disaster and could testify as to the damage done.

Mr. F. Gaster said that the Hon. Rollo Russell, in a paper recently read before the Society, had shown how the mingling of different air currents often produced abnormal falls of rain, and he thought that in the present instance it was the dry cold east wind meeting the

hills and bursting in under the upper moist current from the south-west which caused rapid condensation and the rain to come down through the east surface wind.

Mr. F. J. Brodie said it was remarkable that the neighbourhood of Dublin seemed liable to heavy falls of rain.

Captain M. W. C. Hepworth said that in this part of the world steady rain was usually experienced in front of the trough of depressions, but in parts of the southern hemisphere—on the east coasts of the continents—the weather was usually bright and sunny in front of an approaching depression and the rainfall occurred in rear of it.

Mr. W. Marriott urged the importance of observers seeing that their rain gauges were always kept in good order and were capable of holding at least 5 inches, as such an amount might fall on any day. At Scarborough 9½ inches were measured on August 6th, 1857, but the rainfall actually exceeded that amount as the gauge had overflowed.

Mr. Baldwin Latham, Mr. W. B. Tripp, Mr. J. Hopkinson, and the President also took part in the discussion.

A paper by Dr. W. B. Newton, describing "The Aquameter," was in his absence read by Mr. D. A. Louis. This is a new instrument for measuring the amount of aqueous vapour present in the atmosphere by measuring the reduction of volume produced by the absorption of the water-vapour by phosphoric anhydride.

Dr. W. N. Shaw pointed out that instruments precisely similar in principle had already been tried and found wanting.

Mr. F. Gaster, Mr. D. A. Louis, and the President also took part in the discussion.

The following gentlemen were elected Fellows of the Society:—Capt. G. A. Alcock; Lieut.-Col. J. E. Capper, C.B.; Mr. G. A. Denny; Dr. A. T. Gott; Mr. R. G. F. Grain; Mr. E. Holding; Mr. A. R. Hutson; Dr. G. J. Macaura; Dr. E. M. Modi; Mr. A. E. Moore, B.A.; Capt. A. Simpson; Mr. J. F. Unstead, B.A.; Mr. W. Warren; and Dr. W. G. Willoughby.

Correspondence.

AURORAL DISPLAY OF NOVEMBER 15th.

To the Editor of Symons's Meteorological Magazine.

I SEND you a very feeble representation of "magnetic storm" phenomena as seen here last night, and probably throughout the west generally. I have never seen anything like it. The "show" began after sunset in a cloudless sky; a bright red glow shot through with "streamers," in the west, as though a large fire was burning not far off. This continued for some time. About 9 p.m. the glow

spread in streamers towards the zenith, and beyond it to the east. Then it culminated in a "focus," as I have tried to depict it, due south, about 15° to 20° south of the zenith. At the same time the red glow faded from the west, and became brilliant low down in the east, which was flooded with steady red colour—not "spearing." The moon was up about 30° above the horizon.

The focusing lasted about 20 minutes, then gradually faded. For a considerable time the red band extended from west to east, not in an arch, but continuously; I mean not in a rainbow-like arch, such as I have seen depicted, as northern lights are seen in Arctic regions.

When we first noticed the glow in the west it was so brilliant that I thought the farmsteading must be on fire, and I went up there to give the alarm! This was at 7.45 p.m., and at 8.30 the light was the same; then followed the marvellous vision I have described. The sky to the north was quite clear and still throughout.

What puzzles me is that the "fireworks" went on south of the zenith all the time. Surely magnetic phenomena are usually seen as coming from the north and in the north. These came from the west and extended to the east, south of the zenith, and the east-to-west latitudinal line. G.G.C.

Island of Jura, N.B., 16th November, 1905.

LAST Wednesday evening, (November 15th) there was a faint white aurora borealis from 6.20 to 6.40 p.m. in the N.N.W., with a pink blush to 6.30 p.m.; and a brilliant aurora borealis from 8.45 p.m. to 9.30 p.m.; then a faint white one at 9.40 p.m.; the red colour was in the W. to 9.5 p.m., in N. to N.E. from 9 to 9.15 p.m., and nearly reaching the zenith (with yellow streamers pointing to N.N.W. from 9 to 9.3 p.m.), and in N.N.W. from 9.15 to 9.30 p.m. A N.E. breeze blew all the evening, and the dry and wet bulb thermometers in the screen read 34°·8 and 33°·1 at 9.17 p.m, G. M. T. Low cirrus cloud came slowly from S.E. up to 6 p.m., and radiated to E.S.E. to 8 p.m.; and soft alto-cumulus from N.E. from 7 to 9.20 p.m. Yesterday four spots were visible on the sun through the telescope at 3 p.m.

EDWIN G. GLYDE.

Statsford, Whitchurch, Tavistock, Nov. 17th, 1905.

A VERY bright aurora was seen in this neighbourhood during the evening of November 15th. The phenomenon first became visible at 7.30 p.m. at a point about due north. A narrow arc of a pale yellow colour spanned the northern horizon (the segment of sky beneath the arc being quite black), from which, at times fitful, wavy rays and streamers rose and fell, their colour varying between a pale pink to a blood-red crimson. The aurora towards 8.45 p.m. brightened considerably, and had risen towards the zenith: the sk

at the time was covered with alto-cumulus moving from a northerly point, a succession of bright lunar coronas being visible, in which the predominant colour was green.

At 8.55 p.m. the aurora had developed an irregular formation, the striking feature noticed was the variability in colour, fading at times to a pale subdued pink, brightening up with a peculiar twitching movement to a deep crimson, the interspaces of the blue sky between the alto-cumulus being illuminated a blood-red crimson.

The general appearance was that of the glow from a large conflagration, but the colour was of a much deeper crimson. The phenomenon lasted to 9.30 p.m., when a clearance of cloud from the sky took place, and by 9.35 p.m. all traces were lost.

The last aurora seen in this district previously was on April 14th, 1904, but was not in any way comparable, owing to the absence of streamers and the presence of considerable cloud.

SPENCER C. RUSSELL.

Ashley Road, Epsom, November 18th, 1905.

[The aurora was seen in all parts of the British Isles, and over a considerable part of the continent. At Ghent and Turnhout in Belgium, alarms of fire were raised when the brilliant glow was first observed. It is noteworthy that in Scotland the auroral display appeared to the south of the zenith, while in the more southerly latitudes it appeared in the north. We regret that we cannot reproduce the effective water-colour sketch, illustrating the first of the letters printed above.—ED., *S.M.M.*]

LOW TEMPERATURES IN OCTOBER.

I WAS much interested in the article on Low Temperatures of October in your Magazine of last month.

My record for the 19th was 14°, and for the 20th and 22nd 15°, so I send you a copy for the month. Sixteen nights had minima below 32° and five reached or fell below 20°. No such low temperatures appear in my records so far as I have examined them (to 1883).

ED. B. MARTEN.

Pedmore, near Stourbridge, 22nd November, 1905.

SOME WEATHER PROBLEMS.

THE inquiry suggested by Mr. Alex. B. MacDowall as to a relation between the behaviour of polar ice and the sunspot cycle is one which might well be carried out by observers stationed in places suitable for recording the nature and extent of local ice floes, and no doubt valuable stores of informatiom could be found in the old log books of the Newfoundland sealing fleet. In March they set out for the ice where the seals are. The reputation of a "sealing king" depends upon his knowledge as to the whereabouts of the ice, which varies

greatly from year to year; but he seldom fails to find it, being guided by experience and his own interests.

As I was in Newfoundland in 1895 I can submit the fact that in the Spring of that year for over two months communication with the outside world was practically cut off owing to Arctic ice packing the harbours. The late Professor G. Holloway, who had observed in that country for twenty-six years, informed me that it was a maximum ice floe period; it will be seen that the date suggests relation to the sunspot maximum.

I am inclined to think that Sir William MacGregor, the present Governor of Newfoundland, will take an interest in this subject and give to science the benefit. We have not forgotten his interesting contribution to the Magazine of last September.

FLEETWOOD C. VARLEY.

Park Villa, Campden, Glos., November 19th, 1905.

[The movements of Arctic ice are studied and charted by the Danish Meteorological Institute in accordance with an international arrangement, and further data from Newfoundland would be useful and welcome. Many years' data will be required to prove any relationship to other periodic phenomena.—Ed. *S.M.M.*]

CURIOUS EFFECT OF LIGHTNING.

It was my intention to give you the following particulars of a somewhat peculiar effect of lightning a few days after the event; but circumstances have prevented me from doing so until now.

It was as I think on 27th July last that a severe thunderstorm took place over North London, and extended, as I read in various papers, as far south as Croydon, but we had nothing here beyond sultry heavy atmosphere during the day. At about 4.30 p.m. I heard distant thunder occasionally, no doubt over Croydon, 8 or 9 miles distant, but nothing nearer, when a sharp report like a magnified rifle crack startled my daughters and myself as we sat in our room facing west, and at the same time a vivid flash of jagged lightning across the windows caused me to go outside shortly after to see and enquire whether anything in my grounds had been struck. This house and the one next it are about halfway down the slope of the east side of the hills forming the Harestone Valley, and had any of our chimneys or the trees near by been struck I should have been in no way surprised; but the electric current chose a low terra-cotta chimney nestled down among trees half way down my neighbour's garden, punched a round hole of about three inches diameter without splitting the material at all, satisfying itself by breaking out several bricks of the bedwork of the pot, and throwing them through the stoke-hole roof. Careful search has not yielded any find of a so-called "bolt" of any sort. I should add that no fire was alight, nor had there been one to cause any heated air, which is said to attract

the current down a chimney. The trees adjacent are much higher than the greenhouse or its little chimney, but none of them were touched. The isolated stroke of lightning and its effect appear to me sufficiently unusual to be worth notice.

Any comments you make like to make at your leisure will be read with interest.

HENRY HAES.

Bradenhurst, Caterham Valley, Surrey, 3rd Nov., 1905.

[We should be glad to hear our readers' views on this matter.
ED. *S.M.M.*]

LONG RANGE WEATHER FORECASTING.

THE number of weather-prophets in the United States who issue forecasts for a long period a-head, based on astronomical or other "laws" of their own discovery, induced Professor Willis L. Moore, Chief of the U.S. Weather Bureau, to publish a criticism of some of their claims about a year ago. We have kept the papers issued at that time before us for some months in the hope of dealing somewhat fully with the matter; but the season of endeavouring to clear up arrears of book-notices, so as to start afresh with a new volume, has come, and very reluctantly we must content ourselves with a brief summary. Professor E. B. Garriott deals with the subject in Bulletin 35 of the U.S. Department of Agriculture, Weather Bureau. Professor Moore expresses his views unreservedly in the Letter of Transmittal prefatory to the pamphlet:—

"The success of the United States Weather Bureau in making conservative forecasts of the weather two or three days in advance has created the hope in the minds of the people that it may be possible to foresee the character of the weather for the coming month or season. All scientific men know that at present it is impossible to gratify this wish, and the Government experts so inform all those who make inquiry. But the mistaken investigator of little knowledge, the pseudo-scientist and the astrologer, see their opportunity and at once step into the breach and sell spurious long-range forecasts to a public rendered credulous by the success of the Government scientists. The abuse of the public confidence has become so great that I have thought it justifiable to present to the reader indisputable evidence of the injurious character of monthly or seasonal forecasts."

Professor Moore does not of course question the possibility of scientific research ultimately leading to a safe basis for long-range forecasts, but merely lays stress on the present limitations. An interesting criticism by Professor C. M. Woodward, of Washington University, demolishing a system of "planetary meteorology," is reprinted, as, although published in 1875, the fallacies then refuted are, it is stated, still being exploited in St. Louis. Professor Garriott

sums up his study of the whole question in the following admirable conclusions :—

1.—That systems of long-range weather forecasting that depend upon planetary meteorology ; moon phases, cycles, positions, or movements ; stellar influences, or star divinations ; indications afforded by observations of animals, birds and plants, and estimates based upon days, months, seasons and years have no legitimate bases.

2.—That meteorologists have made exhaustive examinations and comparisons for the purpose of associating the weather with the various phases and positions of the Moon, in an earnest endeavour to make advances in the science along the line of practical forecasting, and have found that while the Moon, and perhaps the planets, exert some influence upon atmospheric tides, the influence is too slight and obscure to justify a consideration of lunar and planetary effects in the actual work of weather forecasting.

3.—That the stars have no appreciable influence upon the weather.

4.—That animals, birds and plants show by their condition the character of past weather, and by their actions the influence of present weather and the character of weather changes that may occur within a few hours.

5.—That the weather of days, months, seasons and years affords no indications of future weather further than showing present abnormal conditions that the future may adjust.

6.—That six and seven day weather periods are too ill-defined and irregular to be applicable to the actual work of forecasting.

7.—That advances in the period and accuracy of weather forecasts depend upon a more exact study and understanding of atmospheric pressure over great areas and a determination of the influences, probably solar, that are responsible for normal and abnormal distributions of atmospheric pressure over the Earth's surface.

8.—That meteorologists are not antagonistic to honest, well-directed efforts to solve the problem of long-range forecasting ; that, on the contrary, they encourage all work in this field and condemn only those who, for notoriety or profit or through misdirected zeal and unwarranted assumptions, bring the science of meteorology into disrepute.

9.—That meteorologists appreciate the importance to the world at large of advances in the period of forecasting and are inclined to believe that the twentieth century will mark the beginning of another period in meteorological science.

THE RELATION BETWEEN THE CIRCULATION OF THE ATLANTIC AND WEATHER.

DR. W. MEINARDUS publishes in the *Meteorologische Zeitschrift* for September the results of an investigation into the relation between the circulation of the water in the North Atlantic Ocean and the weather. The variation of atmospheric pressure between pairs of stations on opposite sides of the ocean was adopted for the purpose of comparing the weather conditions. It became apparent that the air over the whole North Atlantic and the surrounding coasts behaved as one system, in relation to the Icelandic centre of low

pressure, the gradients sometimes steepening and sometimes becoming less marked. When the gradients steepened it was found that the temperature of the Gulf-stream water simultaneously increased also, while when the gradients diminished the temperature of the water simultaneously fell; the pressure difference often being established for some months before the temperature difference appeared. An increase of pressure gradient corresponds also to an increased amount of ice carried southward by the Labrador current, and a diminished gradient to a reduced amount of ice. The latter relationship allows this simple rule for predicting the character of the ice off Newfoundland for the coming summer:—

The amount of ice to be met with off Newfoundland in any particular summer is determined by the atmospheric gradients in the preceding months November to January between the south of Greenland and the mouth of the St. Lawrence, and the amount of ice is directly in proportion to the magnitude of this gradient.

It has been observed also that in most cases years in which much ice is found off Newfoundland are associated with a warm Spring (February to April) in central Europe, and years when there is little ice with a cold Spring. W. Brennecke's investigation of the East Greenland current showed that the position of the limit of ice in summer in the sea east of Greenland was dependent on the magnitude of the gradient of atmospheric pressure between Greenland and northern Scandinavia in the months March to May.

Throwing the whole into a simple form, and remembering that a weak circulation corresponds to a low gradient and a strong circulation to a high gradient, Dr. Meinardus draws these remarkable conclusions; A and B being groups of conditions that are associated together.

A.—1. Weak Atlantic circulation (August—February).
2. Low water temperature on the coasts of Europe (November—April).
3. Low air temperature in Central Europe from February to April.
4. Little ice off Newfoundland in Spring.
5. Much ice off Iceland in Spring.
6. Bad harvests of wheat and rye in western Europe and northern Germany.

B.—1. Strong Atlantic circulation (August—February).
2. High water temperature on the coasts of Europe (November—April).
3. High air temperature in Central Europe from February to April.
4. Much ice off Newfoundland in Spring.
5. Little ice off Iceland in Spring.
6. Good harvests of wheat and rye in western Europe and northern Germany.

The curves which illustrate the paper bear out this relationship in the most striking way.

THE BRITISH ASSOCIATION IN SOUTH AFRICA.

[THIRD ARTICLE.]

WHILE in South Africa we took every opportunity of photographing scenes and objects of meteorological interest, but we had not calculated on the number of films which the attractiveness of the novel sights tempted us to expose, and so we had not a sufficient number of air-tight tin cases in which to bring home the exposed films; hence a certain proportion was lost on account of the deterioration brought about by the heat and dampness of the Red Sea on the homeward voyage. Of the 220 good negatives that came safely through the ordeal, we select four for re-production here. The first shows the standard rain-gauge of the Royal Observatory at Cape Town, the diameter of which is about $11\frac{1}{4}$ inches, so as to give an area just double that of an 8-inch gauge, so that when the rain is measured in a glass for an 8-inch gauge the resulting figure divided by 2 gives the actual fall. No other gauge in Cape Colony, so far as we know, has this great diameter, but all are erected as shown on stone pillars, so that the receiving surface is 4 feet above the ground. In consequence of this, from 3 to 4 per cent. should be added to the readings of South African rain-gauges before comparing them with the figures of rainfall in Great Britain. Mr. J. Power, of

THE STANDARD RAIN-GAUGE AT THE ROYAL OBSERVATORY, CAPETOWN.

METEOROLOGICAL OBSERVATORY, JOHANNESBURG.

the Cape Observatory, is standing with the gauge on his right hand, and Mr. R. T. A. Innes, of the Johannesburg Observatory, is standing between the two pillars.

The second picture shows Mr. Innes standing beside a 5-inch rain-gauge, set up in an iron stand to a height of 4 feet according to the system in use in the Transvaal. The Johannesburg Meteorological Observatory (see p. 174) is seen on the hill in the background, the tall mast on the building carries the Dines' anemometer, and the large louvred shed is seen farther along the ridge on the right.

The third illustration shows the meteorological station at the Hospital in Salisbury, Rhodesia. The 8 inch rain-gauge, mounted on iron legs, the Robinson anemometer, Stevenson screen, sunshine-recorder, and black-bulb thermometer are all to be seen.

THE METEOROLOGICAL STATION, SALISBURY, RHODESIA.

RAIN-GAUGE AT BEIRA, PORTUGUESE EAST AFRICA.

Finally, we give a view of the great rain-gauge at Beira in Portuguese East Africa. Time was pressing, and the native attendant did not speak English, so that we have no particulars of this instrument to impart.

THE BULAWAYO METEOROLOGICAL OBSERVATORY.

By Rev. E. Goetz, S.J.

Meteorological observations were started in Bulawayo in 1897, by the Jesuit Fathers, at St. George's School, with the usual set of meteorological instruments. In 1903 they built a regular observatory, and got registering instruments, which have been recording since January, 1904. These are (1) a Richard Anemometer, recording every kilometer of wind, and directly the four directions electrically. The four intermediate directions are recorded by the simultaneous marking of the two component directions. (2) Richard Barograph, Thermograph, and Hair Hygrometer. (3) A Marvin Sunshine Recorder. (4) A Recording Rain Gauge, constructed at the Observatory, after the U.S. Weather Bureau pattern.

The rain gauge is of the usual bucket pattern, each bucket-full representing one-hundreth of an inch of rain. As the bucket falls over when full it touches a contact, and this contact is recorded. The recorder has been constructed in the following way: the minute hand of an ordinary clockwork has been replaced by a crank, which drives a cylinder revolving round a horizontal axis, and one end of the axis has been turned into a screw, of 2·5 mm. thread. The crank is fixed on the pin which bears the minute hand, but enters loosely into a piece of metal at right angles to the axis of the cylinder. The cylinder is thus revolved, and at the same time brought at each revolution 2·5 mm. nearer the clockwork; a fountain pen connected with the armature of a magnet rests on the cylinder, and draws a continuous line. When the bucket in the rain gauge is full and tumbles over, making a contact, the contact draws the pen momentarily to one side, and thus makes a small mark on the continuous line drawn on the cylinder. The cylinder has a circumference of 33 cm., giving thus a run of a little over 5 mm. per minute. Ten to twelve marks are quite distinct in this space, so that rates of 6 to 7 inches an hour are distinctly recorded. Besides the meteorological instruments there is a complete set of magnetic instruments of the Kew pattern; a magnetometer by Nalder Bros., and a Dover dip circle.

The recording instruments are made by Richard, (Paris); the barometer (inch measure) and Fahrenheit thermometers, by Negretti and Zambra; the barometer (mm. measure) and Centigrade thermometer, by Tonnelet (Paris).

Judging from the records of the last eighteen months, the observations seem to be likely to prove of a certain value on account of the great regularity of the weather. The wind, pressure, temperature, and hygrometer records show a remarkable correlation.

REPORT OF THE BRITISH ASSOCIATION KITE COMMITTEE.

Investigation of the Upper Atmosphere by Means of Kites in co-operation with a Committee of the Royal Meteorological Society.—Fourth Report of the Committee, consisting of DR. W. N. SHAW (*Chairman*), MR. W. H. DINES (*Secretary*), MR. D. ARCHIBALD, MR. C. VERNON BOYS, DR. A. BUCHAN, DR. R. T. GLAZEBROOK, DR. H. R. MILL, PROFESSOR A. SCHUSTER *and* DR. W. WATSON.

The following is the substance of the Report presented to the British Association in Johannesburg.

Apparatus for testing and calibrating the meteorographs has been made by Mr. J. J. Hicks, and consists of an ordinary air-pump with a large receiver. Inside the receiver there is a coil of metal tube, through which warm water or a freezing-mixture can be circulated; there is also a small electric fan to ensure uniformity of temperature throughout the enclosed space. The meteorograph is placed inside, and the pressure and temperature altered in any desired way. A record is kept, and is compared with the trace obtained from the meteorograph when it is taken out of the receiver. Inasmuch as the thermal capacity of the heavy glass receiver and metal plate is very considerable, the process of warming or cooling the interior is a slow one. A few tests have been made for ascertaining the extent to which the temperature correction of the barograph is dependent on the pressure, but generally a quicker plan is employed for testing the thermograph. The instrument is placed in a thin metal case with a water-jacket. The lid is also jacketed, and by circulating a liquid through the jacket, and enclosing the whole arrangement in felt or other non-conducting material, there is no difficulty about rapidly bringing the meteorograph to any desired temperature.

The pen of the hygrograph moves in accordance with the change of length of 4 feet of human hair. The approximate scale is a change of length of ·45 inch from absolute dryness to complete saturation, but a more exact determination is now being made by hanging a small weight at the end of 4 feet of hair in the open, and taking simultaneous readings of its length and of a wet and dry bulb thermometer.

Continuance of Observations.

The apparatus used on board the "Seahorse" was fitted up at Oxshott at the end of September, 1904, and since that date forty-five ascents, giving good records, with an average height of about 4,400 feet, have been made. These include most of the days appointed by the President of the International Aëronautical Commission. The observations for those days are regularly reported to Professor Hergesell, and will appear in the publications of the International Committee.

Kite Ascents at Oxshott.

1904.		Length of Wire.	Maximum Height.	Temperature Decrease (Degrees Fahr.)	Number of Kites
Sept.	30	8,000	5,000	*10	1
Oct.	3	6,200	3,500	14	1
,,	5	8,240	4,650	*10	1
,,	6	7,300	4,250	17	1
,,	7	8,000	5,400	16	1
,,	8	4,800	3,250	12	1
Nov.	3	6,100	3,250	4	1
,,	8	4,560	3,000	13	1
,,	30	7,180	3,800	12	1
Dec.	1	6,700	3,200	*7	1
,,	5	6,200	3,850	16	1
,,	13	6,400	3,280	9	1
,,	16	3,600	2,850	9	1
,,	19	6,100	3,250	13	1
,,	29	9,560	4,400	10	1
1905.					
Jan.	4	8,000	5,500	17	1
,,	5	10,500	5,800	17	1
,,	28	6,300	3,600	*—6	1
,,	30	5,500	2,700	15	1
Feb.	3	6,000	3,350	11	1
,,	4	3,100	2,600	8	1
,,	10	11,600	7,900	*15	2
,,	17	7,300	4,250	16	1
,,	18	8,000	5,200	*5	1
Mar.	2	6,500	4,650	14	1
,,	3	4,200	3,170	11	1
,,	6	5,400	4,600	12	1
,,	8	6,000	4,100	13	1
,,	17	5,100	3,300	12	1
,,	25	4,500	2,880	10	1
,,	28	7,000	4,400	15	1
,,	29	8,000	5,600	17	2
,,	31	10,000	6,500	26	2
Apr.	1	8,000	4,900	13	2
,,	4	9,000	5,470	19	2
,,	7	9,000	6,200	15	2
,,	13	8,000	5,050	21	1
,,	17	5,700	4,000	6	1
,,	24	5,100	3,800	11	1
,,	25	12,000	7,600	20	2
,,	27	10,000	6,000	12	2
,,	28	5,000	3,500	10	1
May	5	10,300	7,600	15	2
,,	8	6,700	4,300	22	2
June	1	12,000	7,300	31	2

* Indicates a temperature inversion.

Comparatively little trouble has been experienced during the winter with any part of the apparatus. The steam engine that was bought last year did not prove satisfactory while in use on the "Seahorse," but has been altered. The wire that was wound on the reel at Crinan is still in use without a join,

although, of course, pieces have occasionally been lost from the end. The chief requirement is a satisfactory kite, which will combine the three characteristics of flying at a good angle, of being stable and not liable to damage in any wind, and of never exerting an excessive pull. Perhaps such a kite can never be obtained, but there are such an infinite number of ways in which the various types of kite now in use may be altered—and the most trifling alterations of detail are sometimes capable of producing very great effects—that extensive experimental work can hardly fail to develop a kite better than any at present available.

Observations are being continued at Oxshott, but it is not proposed to make any attempt to obtain a vessel for work elsewhere this summer.

The Committee was re-appointed without a grant.

REVIEWS.

Solar Physics Committee. Mean Annual Variations of Barometric Pressure and Rainfall in certain regions, being a study of the mean annual pressure variations for a large number of areas scattered over the Earth's surface in relation to the principal types of mean annual rainfall variations in those areas, made at the Solar Physics Observatory, South Kensington, under the direction of SIR NORMAN LOCKYER. London. Printed for H. M. Stationery Office. 1905. Size 12 × 10. Pp. iv. + 16 and 17 plates. Price 1s. 6d.

THIS forms a convenient collection of types of rainfall distribution throughout the year in a great many places situated all over the world. The source of the data is duly acknowledged, but dealing with so wide a geographical range it was, of course, impossible to secure perfect comparability. The period for which the averages are made is different, and in some cases is not known. In most instances the curve for one typical station is taken as representative of a region ; but in other cases the mean of groups of stations is used. Monthly rainfall varies so much that we should place no confidence in means for any one station being representative of the normal incidence of rainfall at that station, unless the period were at least 20 years, and to be in any way satisfactory we would prefer 35 years. When the means of several stations in a region are averaged, the monthly curve becomes much more trustworthy ; but we confess that we should feel many qualifications to be necessary in drawing any generalization from the curves as given.

Anleitung zur Anstellung und Berechnung meteorologischer Beobachtungen. [Introduction to the establishment and calculation of meteorological observations.] Berlin : S. Asher & Co. 1904, 1905. Size 11 × 8. Pp. (Pt. I.) 66, (Pt. II.) 50. Plates. Price 2m. each part.

THESE instructions are set forth by the Royal Prussian Meteorological Institute for the use of observers in northern Germany. Part I. deals with second and third order stations, and Part II. with first

order stations. The minuteness of the instructions is noteworthy; extending even to a specimen form of recipe for painting the thermometer screen.

Conseil Permanent International pour l'Exploration de la Mer. General Report on the work of the period, July, 1902—July, 1904. With 10 Appendcies. Copenhagen: 1905. Size $11 \times 2\frac{1}{2}$. Pp. 452. Plates.

North Sea Fisheries Investigation Committee. Report on Fishery and Hydrographical Investigations in the North Sea and adjacent waters, conducted for the Fishery Board for Scotland . . . by D'ARCY WENTWORTH THOMPSON, C.B. 1902–1903. London: Printed for H. M. Stationery Office, 1905. [Cd. 2612.] Size $14\frac{1}{2} \times 11$. Pp. viii. + 618. Plates. Price 8s. 9d.

International Fishery Investigations. First Report on Fishery and Hydrographical Investigations in the North Sea and adjacent waters (Southern Area). Conducted for His Majesty's Government by the Marine Biological Association of the United Kingdom. 1902-1903. London: Printed for H. M. Stationery Office, 1905. [Cd. 2670.] Size $14\frac{1}{2} \times 11$. Pp. x. + 378. Plates. Price 8s. 9d.

THESE are merely a selection from the great amount of published data accumulated in the course of the work of the International Council for the Study of the Sea. We notice them because, although the benefits likely to result to meteorology are of the nature of bye-products in the improvement of the fisheries, they are certain to be important. The summary of Dr. Meinardus's work on the influence of the ocean on weather, on another page, will show in what direction the results may be looked for. In the General Report there are two valuable memoirs dealing with the conditions of the North Atlantic and their influence on climate, by Professor Pettersson and Mr. Knudsen. In the Fishery Board Report there is a full translation of a valuable paper by Drs. Sandström and Helland-Hansen on the mathematical investigation of ocean currents, which deserves a wider circulation than a blue-book is likely to afford. A great part of both the Scottish and the English volumes is devoted to the physical study of the northern North Sea and the English Channel, and these are copiously illustrated by maps. The work has been done by Mr. A. J. Robertson at Dundee, and Mr. D. J. Matthews at Plymouth.

Resultats du Voyage du S. Y. Belgica. Météorologie, Rapport sur les observations météorologiques horaires [Report on hourly meteorological observations] par HENRYK ARÇTOWSKI. Anvers: 1904. Size, 13×11. Pp. $52 + 150 + 23$ plates.

M. ARÇTOWSKI, the enthusiastic meteorologist of the Belgian Antarctic Expedition, presents in this volume his complete report on

the hourly observations made during the first Antarctic winter ever endured by human beings. The *Belgica* was frozen in an icefloe, which during more than a year drifted to and fro between 69° 38′ and 71° 36′ S. latitude and 80° 30′ and 96° 40′ W. longitude. The climate was that of the frozen sea to the north of any Antarctic land that may lie between those meridians, and that land does lie at no very great distance to the south the depths of the sea show quite clearly. The observations were made for the most part by M. Arctowski himself, and always under his immediate supervision. We consider that the discussions gain immeasurably in value from this fact. When a stranger attempts to deal with a mass of figures obtained by others in conditions of which he knows nothing, he is apt to draw wrong conclusions as to the degree of trustworthiness of the observations; while, on the other hand, an observer without the knowledge of a trained meteorologist is apt to miss opportunities or to fail to recognise defects in instruments or methods of work. The *Belgica's* records were made and discussed by a man fully alive to their importance, and singularly competent to undertake both tasks. The hourly readings are printed in full—and how we envy M. Arctowski the splendid breadth of his 9½in. page!—and the traces of the Richard barograph, thermograph and hygrograph are reproduced exactly as they were taken from the instruments, the action of which seems to have been remarkably good in the trying circumstances.

The mean and extreme monthly temperatures have frequently been quoted as given in the preliminary notices. They are now given in their final form, the means being those of the whole number of hourly readings made in the month, and the extremes the absolutely highest and lowest recorded for any hour in the month. The mean barometric pressure for the year was 29·339 in., the highest reading 30·398 in., and the lowest 28·020 in.

Temperatures in ca. 70° S., 1898-99.

	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Year
Mean °F.	16·0	10·7	20·2	4·1	−10·7	11·6	−1·5	17·9	19·6	27·8	29·8	30·0	14·8
Max. „	31·1	31·1	33·4	32·0	30·0	32·5	33·6	33·4	33·8	36·5	35·2	34·0	36·5
Min. „	−4·5	−15·7	−13·4	−24·2	−34·8	−21·6	−45·6	−15·3	−6·5	5·4	16·9	14·4	−45·6

The average daily range was 13·6 Fahrenheit degrees, and the greatest range in any one day (21st July, 1898, a month after midwinter) was 49°·3.

Jelinek's Anleitung zur Ausfuhrung meteorologischer Beobachtungen. [Jelinek's Introduction to Meteorological Observing]. Wien: 1905. Size, 10 × 7. Pp. 124.

THIS is Part I. of the fifth revised edition of the official Austrian handbook for meteorological observers. It is so thoroughly brought up to date as to contain a section dealing with the method of proceeding on finding an unmanned balloon which has fallen with a meteorograph attached.

METEOROLOGICAL NEWS AND NOTES.

THE SYMONS GOLD MEDAL of the Royal Meteorological Society, established in memory of the founder of British Rainfall, has been awarded to Lieutenant-General Richard Strachey, G.C.S.I., for many years Chairman of the Meteorological Council, in recognition of the services he has rendered to the science of Meteorology. The two previous recipients of this medal have been Dr. A. Buchan and Dr. Julius Hann.

NOCTURNAL RADIATION as influenced by water vapour is the subject of a paper by Mr. J. R. Sutton, of Kimberley, in the *Proceedings* of the Royal Dublin Society for August last. He concludes that the fall of temperature at night becomes less rapid as the relative humidity increases, but that the absolute humidity of the air has no influence at all on radiation.

HEAVY RAINS IN THE RHINE DISTRICT on June 17th, 1904, gave Dr. P. Polis, of Aix-la-Chapelle, an opportunity of constructing a detailed rainfall map of some 20,000 square miles of country, making use for this purpose of the observations from 636 stations. Maps of a single day's rainfall constructed on this principle are familiar to readers of "British Rainfall," but Dr. Polis has the advantage of presenting his map on a large scale, and in all the glory of colour-printing, in the pages of *Petermanns Mitteilungen*, for September last. The greatest fall in 24 hours at any station during the storm was 3·20 in., and the total area with a rainfall greater than 2·75 in., was 152 square miles, so that as regards area affected by very heavy rain, it was not very remarkable judged from the standpoint of rain storms in the United Kingdom. The rain was heaviest in patches, fairly regularly placed in three parallel lines, a formation typical of thunderstorms. A second map shows the lines along which the first thunder of the various thunderstorms which brought the rain was heard simultaneously.

THE HIGHEST KITE ASCENT yet made for meteorological purposes was accomplished at the aeronautical observatory at Lindenberg, on 25th November, 1905, according to our contemporary *Das Wetter*. Records were secured at an elevation of 21,096 feet by means of a team of six kites, and a total length of wire paid out of 47,573 feet, or almost exactly nine miles. The pressure at the highest point was 12·99 in., and the temperature —13°·0 F., that on the ground being 40°·8 F. This ascent exceeds by 1000 feet the highest previously obtained, by M. Teisserenc de Bort, on a Danish gunboat, in the Baltic; but higher flights have frequently been made by free balloons.

THE LOWEST AIR TEMPERATURE yet observed appears to be that recorded in a free balloon ascent from St. Louis, in December, 1904, when —122°·1 F. was found; but this was practically equalled at Vienna, on 2nd March, 1905, when —121°·7 F. (154° of frost) was registered at a height of 31,880 feet. At greater heights, up to 37,300 feet, the temperature though more than 100° below zero, was not quite so low as that quoted.

RAINFALL AND TEMPERATURE, NOVEMBER, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE Max. Deg.	Date.	Min. Deg.	Dat
		inches	inches.	in.						
I.	London (Camden Square) ...	3·08	+ ·63	·46	2	19	55·2	26	24·2	2
II.	Tenterden ...	4·24	+ 1·02	·71	11	22	56·0	8	28·0	2
,,	Hartley Wintney ...	3·19	+ ·16	·66	10	20	53·0	3, 23	23·0	2
III.	Hitchin ...	2·40	— ·16	·44	26	15	53·0	26	26·0	2
,,	Winslow (Addington) ...	3·21	+ ·58	·75	26	15	53·0	2, 3*a*	22·0	2
IV.	Bury St. Edmunds (Westley)	2·16	— ·34	·35	26	20	55·0	1	25·0	2
,,	Brundall ...	1·95	— ·76	·55	11	19	54·2	26	23·6	2
V.	Alderbury ...	3·56	+ ·37	·82	10	17	55·0	4	18·0	2
,,	Winterbourne Steepleton ...	6·70	+ 1·88	1·21	10	21	54·3	4	18·3	2
,,	Torquay (Cary Green) ...	5·39	+ 1·68	·88	12	16	55·7	4	25·8	2
,,	Polapit Tamar [Launceston]	5·72	+ 1·43	1·08	1	21	53·6	4	...	...
,,	Bath ...	3·08	+ ·02	·59	10, 12	17	55·2	25	24·6	1
VI.	Stroud (Upfield) ...	3·77	+ ·78	·71	10	21	53·0	2	25·0	1
,,	Church Stretton (Woolstaston)	3·37	+ ·19	·63	10	20	50·5	8	22·0	1
,,	Bromsgrove (Stoke Reformatory)	2·29	+ ·02	·68	10	16	49·0	2	18·0	1
VII.	Boston ...	2·45	+ ·31	·57	26	14	50·0	12	26·0	1
,,	Worksop (Hodsock Priory).	2·56	+ ·46	·63	10	17	53·0	6	23·5	2
,,	Derby (Midland Railway)...	2·50	+ ·22	·42	10	21	53·0	2	23·0	2
VIII.	Bolton (The Park) ...	5·12	+ 1·21	·67	22	23	50·8	11	25·7	1
IX.	Wetherby (Ribston Hall) ...	4·24	+ 2·01	·83	1	19	...	...	...	...
,,	Arncliffe Vicarage ...	7·39	+ 1·39	·99	26	25	...	...	...	...
,,	Hull (Pearson Park) ...	2·95	+ ·50	·37	11, 28	22	52·0	2, 26	23·0	18, 1
X.	Newcastle (Town Moor) ...	4·50	+ 1·85	·75	1	26	...	...	...	...
,,	Borrowdale (Seathwaite) ...	13·92	+ ·01	3·20	22	18	51·3	22	20·4	1
XI.	Cardiff (Ely) ...	4·22	— ·04	·83	10	22	...	...	...	...
,,	Haverfordwest (High St.)..	6·93	+ 1·52	1·30	10	23	53·4	10, 11	25·0	1
,,	Aberystwyth (Gogerddan)..	4·07	— ·61	·60	10, 22	15	65·0	2	21·0	16, 1
,,	Llandudno ...	3·86	+ ·48	·94	27	20	56·0	23	27·2	1
XII.	Cargen [Dumfries] ...	4·75	+ ·25	·80	10	16	52·0	3, 23	18·0	1
,,	Lilliesleaf (Riddell) ...	3·38	+ ·09	·77	1	21	51·0	20	17·0	1
XIII.	Edinburgh (Royal Observy.)	3·36	...	·62	3	20	53·2	23	24·0	1
XIV.	Colmonell ...	6·68	+ 1·81	1·58	10	16	52·0	11, 22	18·0	1
XV.	Tighnabruaich ...	6·78	+ ·57	1·10	25	18	46·0	1, 3	25·0	1
,,	Mull (Quinish) ...	5·80	— ·63	1·19	29	20	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	4·35	+ 1·59	·70	26	19	51·9	22	19·0	1
XVII.	Braemar ...	6·87	+ 2·93	·79	1	27	50·0	23	5·2	1
,,	Aberdeen (Cranford) ...	6·83	+ 3·36	·88	26	23	50·0	1, 2	18·0	1
,,	Cawdor (Budgate) ...	3·71	+ 1·06	1·06	26	21	...	...	...	...
XVIII.	Invergarry ...	6·22	+ ·24	1·15	21	14	...	...	...	...
,,	Bendamph ...	8·07	— 1·72	2·02	22	23	...	...	...	...
XIX.	Dunrobin Castle ...	4·01	+ ·75	·63	27	26	53·5	23	26·5	2
,,	Castletown ...	5·00	...	·68	11	27	48·0	2, 22	25·0	1
XX.	Killarney ...	5·57	— ·28	·85	23	24	58·0	5	22·0	1
,,	Waterford (Brook Lodge)...	4·38	+ ·47	·79	12	21	54·0	3	22·0	1
,,	Broadford (Hurdlestown) ...	2·95	— ·24	·49	29	22	52·0	12	21·0	1
XXI.	Carlow (Browne's Hill) ...	3·34	+ ·20	·48	4	18	...	...	...	...
,,	Dublin (Fitz William Square)	3·55	+ ·95	·68	1	19	55·9	22	23·6	1
XXII.	Ballinasloe ...	2·50	— 1·10	·45	25	22	...	...	...	...
,,	Clifden (Kylemore House)..	7·12	— 1·13	1·55	25	22	...	...	...	...
XXIII.	Seaforde ...	5·04	+ 1·10	1·57	10	22	51·0	11	27·0	17, 1
,,	Londonderry (Creggan Res.)	4·85	+ ·66	·91	26	27	...	...	...	...
,,	Omagh (Edenfel) ...	3·86	+ ·33	·60	25	21	52·0	22	20·0	1

+ Shows that the fall was above the average; — that it was below it. *a* and 26.

SUPPLEMENTARY RAINFALL, NOVEMBER, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	4·94	XI.	New Radnor, Ednol	4·49
,,	Ramsgate, West Cliff	2·57	,,	Rhayader, Nantgwillt	5·88
,,	Hailsham	5·68	,,	Lake Vyrnwy	5·63
,,	Crowborough	6·10	,,	Ruthin, Plâs Drâw	4·66
,,	Osborne	4·66	,,	Criccieth, Talarvor	4·88
,,	Emsworth, Redlands	4·00	,,	Anglesey, Lligwy	5·43
,,	Alton, Ashdell	4·25	,,	Douglas, Woodville	4·88
,,	Newbury, Welford Park	4·72	XII.	Stoneykirk, Ardwell House	4·91
III.	Harrow Weald	2·80	,,	Dalry, Old Garroch	8·26
,,	Oxford, Magdalen College	2·57	,,	Langholm, Drove Road	5·09
,,	Banbury, Bloxham Grove	3·72	,,	Moniaive, Maxwelton House	5·39
,,	Pitsford, Sedgebrook	2·74	XIII.	N. Esk Reservoir [Penicuick]	3·65
,,	Huntingdon, Brampton	1·95	XIV.	Maybole, Knockdon Farm	3·91
,,	Wisbech, Bank House	1·85	,,	Glasgow, Queen's Park	3·37
IV.	Southend	2·27	,,	Campbeltown, Redknowe	6·41
,,	Colchester, Lexden	1·90	XV.	Inveraray, Newtown	6·76
,,	Saffron Walden, Newport	2·55	,,	Ballachulish House	7·68
,,	Rendlesham Hall	2·05	,,	Islay, Eallabus	6·13
,,	Swaffham	2·31	XVI.	Dollar	6·37
,,	Blakeney	1·83	,,	Loch Leven Sluices	6·03
V.	Bishops Cannings	3·20	,,	Balquhidder, Stronvar	...
,,	Ashburton, Druid House	6·92	,,	Coupar Angus Station	5·07
,,	Okehampton, Oaklands	5·23	,,	Blair Atholl	3·80
,,	Hartland Abbey	5·32	,,	Montrose, Sunnyside	7·61
,,	Lynmouth, Rock House	4·34	XVII.	Alford, Lynturk Manse	8·03
,,	Probus, Lamellyn	5·59	,,	Keith	8·11
,,	Wellington, The Avenue	3·36	XVIII.	N. Uist, Lochmaddy	4·03
,,	North Cadbury Rectory	4·08	,,	Aviemore, Alvey Manse	3·33
VI.	Clifton, Pembroke Road	3·02	,,	Loch Ness, Drumnadrochit	4·41
,,	Moreton-in-Marsh, Longboro'	3·82	,,	Glencarron	7·85
,,	Ross, The Graig	3·69	,,	Fearn, Lower Pitkerrie	3·23
,,	Shifnal, Hatton Grange	2·38	XIX.	Invershin	5·36
,,	Wem Rectory	2·62	,,	Altnaharra	5·45
,,	Cheadle, The Heath House	3·78	,,	Bettyhill	4·06
,,	Coventry, Kingswood	2·89	,,	Watten	4·01
VII.	Market Overton	2·92	XX.	Cork	4·64
,,	Market Rasen	3·12	,,	Darrynane Abbey	5·90
,,	Bawtry, Hesley Hall	2·48	,,	Glenam [Clonmel]	4·31
VIII.	Neston, Hinderton	3·25	,,	Ballingarry, Gurteen	2·46
,,	Southport, Hesketh Park	4·77	,,	Miltown Malbay	3·53
,,	Chatburn, Middlewood	4·71	XXI.	Gorey, Courtown House	4·31
,,	Cartmel, Flookburgh	5·39	,,	Moynalty, Westland	3·49
IX.	Langsett Moor, Up. Midhope	6·59	,,	Athlone, Twyford	2·87
,,	Scalby, Silverdale	5·27	,,	Mullingar, Belvedere	3·41
,,	Ingleby Greenhow	7·20	XXII.	Woodlawn	2·93
,,	Middleton, Mickleton	3·85	,,	Westport, Murrisk Abbey	5·65
X.	Beltingham	3·36	,,	Crossmolina, Enniscoe	8·52
,,	Font Reservoir, Fallowlees	5·60	,,	Collooney, Markree Obsy	4·70
,,	Ilderton, Lilburn Cottage	6·01	XXIII.	Enniskillen, Portora	3·02
,,	Keswick, The Bank	6·13	,,	Warrenpoint	3·60
XI.	Llanfrechfa Grange	4·82	,,	Banbridge, Milltown	2·68
,,	Treherbert, Tyn-y-waun	8·11	,,	Belfast, Springfield	3·75
,,	Carmarthen, Friary	5·37	,,	Bushmills, Dundarave	4·37
,,	Castle Malgwyn	5·00	,,	Stewartstown	3·50
,,	Plynlimon	8·00	,,	Killybegs	4·96
,,	Tallyllyn	3·20	,,	Horn Head	4·51

METEOROLOGICAL NOTES ON NOVEMBER, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—The most prominent features of an ungenial month were the large amount of gloomy weather with frequent R, and the excessive humidity. There were a few clear cold days in the third week with two sharp frosts, but otherwise no two consecutive days without measurable precipitation. Duration of sunshine 33·5* hours, and of R 68·9 hours. Mean relative humidity 92·2 per cent. Mean temp. 41°·7, or 1°·3 below the average.

TENTERDEN.—A wet month except for the week of frost from 16th to 22nd. Windy on 11th, 23rd and from 26th to 28th. Duration of sunshine 66† hours.

CROWBOROUGH.—Notwithstanding the heavy and continuous R, the month was not unpleasant, having many bright sunny days and mild nights. The only dry days were from 16th to 21st, and the R was 2·44 in. above the average. Mean temp. 41°·3. Severe gale from the night of 25th to 10 p.m. on 26th.

HARTLEY WINTNEY.—Cold, dreary, foggy and wet, with several frosty nights. S.W. gale on 26th. Beautiful display of Aurora on 15th from 5.30 to 9 p.m. Mean amount of ozone 4·2.

PITSFORD.—A few days in the middle were fine and bright, but it was mostly wet and gloomy. R ·32 in. above the average. Mean temp. 39°·5.

COLCHESTER.—Damp and cold with several foggy mornings. Fine displays of Aurora Borealis at 6 p.m. and 8.15 p.m. on 15th.

BURY ST. EDMUNDS.—A month of usual November weather. No severe frost. R was insufficient to fill up ponds and wells.

BRUNDALL.—Mean temp. 41°·0, being 2°·8 below the average, and the lowest in November since 1896. Bright Aurora Borealis on the evening of 15th.

TORQUAY.—Mean temp. 44°·6, or 1°·8 below the average. Duration of sunshine 103·3* hours, or 36·0 hours above the average. Mean amount of ozone 4·2; max. 8·0 on 26th and 27th; min. 1·0 on 14th and 22nd.

WELLINGTON.—Rough and stormy, but with no very violent gales. R about ·25 in. above the average. Temp. generally low after 12th, especially about 18th.

NORTH CADBURY.—The wettest and windiest November in 10 years, and with two exceptions the coldest. There were three bar. depressions with readings below 29 in. A cold spell with some bright days occurred from 16th to 21st.

CLIFTON.—Mild and rainy till 14th, followed by a week of dry cold weather with N.E. wind and night frosts. From 22nd to 30th it was mild and rainy. R ·33 in. below the average.

ROSS.—Very cold till 22nd, especially in the third week, the mean temp. on 22nd being only 27°·2, and that for the whole month being 3°·0 below the average. The first 12 days were wet and R accompanied the gale of 26th. R about 25 per cent. above the average.

BOLTON.—The R was the greatest and the mean bar. the lowest on record. The first part of the month was mild with copious R and no frost. From 15th to 22nd was cold and dry, and from 23rd to the end the temp. was normal. Duration of sunshine 14·7* hours on 12 days, being 10·9 hours below the average. Mean temp. 40°·4, or 2°·5 below the average.

SOUTHPORT.—Characterized by abnormally low mean bar. and decidedly excessive R, but with remarkably light winds except on one day. Mean temp. 2°·9 below the average, owing to a brief period of excessive cold during the third week. Duration of sunshine 7* hours above the average. R 1·50 in. above the average.

UPPER MIDHOPE.—From 1st to 14th was very wet, followed by a spell of wintry weather from 15th to 21st, and again wet from 22nd to 30th, making the wettest November since 1888 except 1901.

LILBURN.—The weather was chiefly remarkable for excessive R and S storms. On 18th and 19th occurred the severest frosts ever remembered in November.

CARMARTHEN.—On the whole fine, the R falling mostly at night. From 15th to 21st the days were bright and fine with frost. There was a storm of considerable severity on the night of the 10th, when 1·02 in. of R fell.

HAVERFORDWEST.—Exceptionally cold, with large R which mostly fell in the night. The fall was the greatest since 1872. Duration of sunshine 76·7* hours. Bright Aurora on 15th.

GOGERDDAN.—Rather wet and damp, with low bar. but little fog. Stormy towards the end.

DOUGLAS.—The beginning and the end were very wet, with a brilliantly fine but cold period from 12th to 22nd with frost almost nightly. The weather on the whole was unusually quiet, although the bar. was low throughout. A N.W. gale of great violence occurred on 26th.

SCOTLAND.

LANGHOLM.—R ·21 in. below the average of 29 years.

INVERARAY.—Variable weather throughout. The Aurora Borealis on the evening of 15th was very beautiful.

MULL, QUINISH.—Very fine until 21st, but thereafter wet and unsettled, with sudden gales of great violence from nearly all points of the compass. Vivid Aurora Borealis on 16th [? 15th—].

COUPAR ANGUS.—Excessive R for the first time since March. The month was noteworthy for a long cold snap following 17th, and the mean temp. was about 2° below the average.

ABERDEEN.—Wet and cold with little sunshine. In upland districts crops were not yet got in and were in bad condition.

LYNTURK.—The month was notable for the excessive R, for the fall of 2·18 in. on 11th, and for the min. temp., 7°·2, on 17th.

DRUMNADROCHIT.—R 1·36 in. above, and rainy days equal to, the average of 19 years. The display of Aurora on the 15th was very fine; there had been hardly any Auroræ for years.

CASTLETOWN.—Cold and wet throughout. In farms where harvesting was rather late, the crops were still lying in the fields at the end. Corn and turnip crops were generally below the average and potatoes were badly diseased.

IRELAND.

CORK.—R ·58 in. above the average. Mean temp. 6°·3 below the average, being the lowest in 25 years. As usual it was a foggy month.

DARRYNANE ABBEY.—R 91 per cent. of the average. Strong gale from N.W. on 26th, but on the whole rather less wind than usual in November. Sharp frost from 15th to 19th.

DUBLIN.—Cold, foggy, damp and wet. Mean temp. 42°·7, or 2°·7 below the average. S on the ground on 18th and 19th. Bright Aurora on the evening of 15th.

BANBRIDGE.—R ·11 in. below the average of 40 years.

BELFAST.—Foggy weather prevailed, with frost at intervals. R slightly under the average.

OMAGH.—With the exception of a short sharp spell of night frost in the third week and again at the close, the weather was damp and dark. The small excess of R did nothing to redress the previous deficiency, and springs had not been so low in November for at least 44 years, probably much longer.

* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, June, 1905.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	81·9	22	46·2	7	71·3	53·0	53·9	79	129·9	44·7	4·39	17	6·9
Malta	93·9	30	59·9	3	81·0	64·7	64·5	79	138·5	55·3	·02	1	2·2
Lagos	88·0	15	69·0	13	83·1	73·7	74·6	85	141·0	62·5	25·59	25	8·1
Cape Town	70·8	2	40·9	1	60·7	48·7	50·2	81	...	...	13·29	19	5·6
Durban, Natal	79·9	18	45·4	14	72·4	53·8	...	...	132·0	...	11·12	5	3·9
Johannesburg	66·6	5	28·7	12	58·6	39·1	32·8	63	120·2	17·5	·00	0	1·7
Mauritius	78·7	9*a*	53·0	26	76·7	62·6	62·2	80	141·9	45·1	2·67	14	5·2
Calcutta	106·1	16	74·1	26	96·7	81·0	78·7	75	161·0	70·9	1·60	4	6·4
Bombay	93·9	20	76·6	26	91·3	82·0	77·0	75	144·5	74·8	6·53	13	5·5
Madras	108·2	2	77·2	17	102·4	82·1	71·8	62	149·8	76·0	·98	7	3·3
Kodaikanal	70·9	3	49·7	12	65·5	54·2	52·1	79	146·0	44·4	3·38	17	6·9
Colombo, Ceylon	88·2	15*b*	74·5	20	86·0	77·9	74·5	83	144·0	73·0	4·45	25	7·1
Hongkong	88·6	30	69·8	22	85·0	77·4	75·2	83	146·3	...	19·70	20	8·9
Melbourne	62·2	8	37·4	16*c*	56·7	46·6	44·2	79	116·3	30·0	1·32	15	8·7
Adelaide	64·2	7, 21	40·9	13*d*	59·6	47·8	46·8	80	119·5	35·7	3·71	19	7·9
Coolgardie	70·0	7	34·2	18	61·5	42·1	40·1	65	137·0	24·2	·50	4	3·4
Sydney	68·1	22	40·7	25	61·1	47·8	43·2	77	105·1	31·9	2·19	20	3·9
Wellington	61·7	14	30·5	5	52·6	42·3	41·8	82	102·5	27·0	8·75	21	6·6
Auckland	62·0	14	37·0	5	58·5	47·9	47·3	81	115·0	31·0	6·00	23	6·0
Jamaica, Negril Point	90·2	23	68·7	7	86·2	73·2	72·9	77	...	...	4·22	7	...
Trinidad	89·0	8, 23	69·0	1*e*	86·9	70·8	72·0	78	165·0	63·0	6·01	12	...
Grenada	86·2	16	71·8	3	83·6	74·7	71·5	79	145·0	...	6·64	25	4·3
Toronto	85·2	20	39·9	1	73·4	53·7	55·5	76	...	33·6	3·19	14	5·9
Fredericton	88·7	16	31·2	7	68·7	45·7	45·5	59	...	...	2·43	8	6·4
Winnipeg	84·5	12	35·0	10*f*	69·3	47·6	...	...	...	...	4·62	15	5·9
Victoria, B.C.	68·7	17	47·3	14	62·8	50·5	...	...	...	...	1·06	8	5·6
Dawson	85·7	24	32·6	11	70·4	48·0	...	...	...	...	·25	2	4·4

a and 12, 19, 20. *b* and 16, 17. *c* and 27. *d* and 20. *e* and 17, 26. *f* and 21.

MALTA.—Mean temp. of air 71°·6. Mean temp. of sea 73°·8. Mean hourly velocity of wind 7·1 or 1·6 below average. T88 on 4th.

Capetown.—The rainfall is the greatest ever registered here in one month, the previous record being 11·41 in. in June, 1892.

Durban.—In 24 hours, ending 3 p.m. on 1st, 11·00 in. R fell.

Mauritius.—Mean temp. of air 0°·2, dew point 1°·1, and rainfall ·61 in. above, averages. Mean hourly velocity of wind 8·4 miles, or 2·8 below average.

KODAIKANAL.—Bright sunshine 132 hours. Mean daily wind velocity 398 miles.

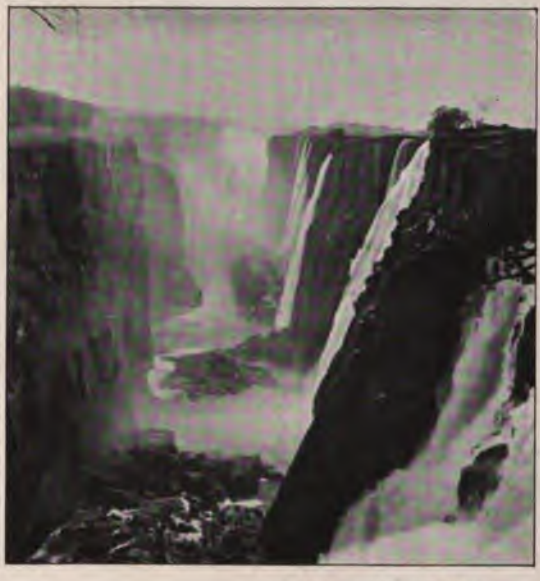
COLOMBO.—Mean temp. of air 81°·2 or 0°·1 above, of dew point 0°·3 above, and R 3·72 in. below averages. Mean hourly velocity of wind 11·2 miles.

HONGKONG.—Mean temp. of air 81°·1. Mean direction of wind E.S.E. and mean hourly velocity 11·4 miles. Bright sunshine 144·3 hours.

Adelaide.—Mean temp. of air 0°·3 above, R ·78 in. above, averages. Most cloudy June on record; sunshine 77 hours, or 45 below average.

Sydney.—Mean temp. of air 0°·1 above, and R 3·23 in. below, averages.

Wellington.—Mean temp. of air 2°·4 below, and R 3·77 in. above, averages.



[*Photograph by The Editor*

THE CHASM OF THE VICTORIA FALLS OF THE ZAMBESI SHOWING THE RIVER AT A MINIMUM TOWARDS THE END OF THE DRY SEASON, ON 12TH SEPTEMBER, 1905. IN THE WET SEASON THE ENORMOUS VOLUME OF WATER WOULD MAKE IT IMPOSSIBLE TO OBTAIN SUCH A VIEW ON ACCOUNT OF SPRAY, OR TO REACH THE STANDPOINT FROM WHICH IT WAS TAKEN. THE CHASM IS 400 FT. DEEP AND A MILE LONG.

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No. 480. JANUARY, 1906. Vol. XL.

THE RAINFALL OF 1905.

The Aggregate Table this month takes the form of a summary of the total rainfall for the year in relation to the average. The month of December proved to be dry in all parts of the country and remarkably so in most parts of England, where an absolute drought of 18 days prevailed in many places. The results shown in the following table were supplemented by data from a number of additional stations which were published in a special article in *The Times* of January 12th. The average of 84 well-distributed stations shows that in 1905 the general rainfall of England and Wales was only 83 per cent. of the average, showing a deficiency of 17 per cent., or 5·76 in.; the general rainfall of Ireland was 89 per cent. of the average, a deficiency of 11 per cent., or 4·65 in.; the general rainfall of Scotland was 96 per cent. of the average, the deficiency being unimportant, only 4 per cent., or 1·91 in.; while the general rainfall of the British Isles was 87 per cent., indicating a deficiency of 13 per cent., or 5·10 in. over the whole surface. The year was thus exceptionally dry, and maintains the sequence of one wet year followed by two dry years which has now prevailed for the country as a whole for 15 years. The time of reversal of the three-year period has evidently not yet arrived, though Mr. Jenkins's recent discussion of the matter leads one to expect the present order of things to change and give place to another before very long.

The geographical distribution of the variation from average rainfall is remarkable. The west and north of Scotland had slightly more than the average amount, the relatively wettest part of the British Isles being the district bordering the south shore of the Moray Firth, where the excess exceeded 10 per cent. The south-east of Scotland had a deficiency of more than 20 per cent., and so had almost the whole of north-eastern, central and south-western England. The south-east of England, including Cambridge, Norfolk, Suffolk, Hertford, London, most of Essex and Kent, Surrey and Sussex had a deficiency less than 10 per cent., the rainfall having been relatively greater than in other parts of England. The greatest deficiency was experienced in a diagonal belt of country, fifty miles wide, running south-westward from the East Riding of Yorkshire to South Devon,

Aggregate of Rainfall for January—December, 1905.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	22·97	91	Bolton	39·20	92	Braemar	35·43	98
Tenterden	26·74	94	Wetherby.....	22·74	84	Aberdeen	31·19	94
Hartley Wintney	23·38	86	Arncliffe	51·25	84	Cawdor	30·22	103
Hitchin	23·26	94	Hull	20·19	75	Invergarry ...	55·78	100
Winslow	21·19	79	Newcastle.....	21·49	77	Bendamph ...	86·53	100
Westley.....	21·86	86	Seathwaite ...	116·92	88	Dunrobin	31·80	101
Brundall	22·96	90	Cardiff, Ely ...	32·84	77	Killarney ...	46·37	80
Alderbury	25·78	88	Haverfordwest	39·23	82	Waterford ...	33·48	85
Winterbourne ...	31·20	80	Gogerddan ...	41·21	91	Broadford.....	30·45	91
Torquay	27·88	80	Llandudno ...	26·05	84	Carlow	28·80	84
Polapit Tamar ...	32·85	85	Cargen	34·69	80	Dublin	25·29	91
Bath	22·79	74	Lilliesleaf	26·63	81	Mullingar.....	31·98	88
Stroud, Upfield...	25·94	87	Colmonell	41·44	92	Ballinasloe ...	28·47	77
Woolstaston	26·16	79	Glasgow	29·62	83	Clifden	63·20	79
Bromsgrove	20·04	82	Inveraray	68·53	109	Crossmolina ...	47·48	94
Boston	20·99	90	Islay, Eallabus	51·79	109	Seaforde	33·70	87
Hodsock Priory..	16·91	68	Mull	56·32	98	Londonderry..	36·53	89
Derby.....	17·43	67	Dundee	22·20	77	Omagh	36·09	95

the general deficiency in which was 24 per cent., or practically one quarter of the average fall. A considerable portion of this belt in the valley of the Trent had a deficiency exceeding 30 per cent., and the lowest percentages of the average rainfall amongst the records dealt with occurred here, at Derby 67 per cent. and at Hodsock Priory, near Worksop, 68 per cent. England and Wales may be divided into five parallel belts 50 miles wide, two north-east and two south-west of the dry belt, as shown on the accompanying map, which distinguishes regions with more than the average rainfall as black, and those with less than 80 per cent. of the average as white. It is then found that the general rainfall in each belt, taken in order from north-west, diminished to the central one and then increased, the percentages running 85, 83, **76**, 82, 90, as given on the side of the map, thus showing that for some reason

the deficiency of rainfall was greatest along the plain which runs from the Severn valley north of the Oolitic escarpment to the Vale of York, and that the deficiency was less and less marked towards the north-west and the south-east. It may be that the tracks of the storm centres crossing England during the year fell so that the zone of maximum rainfall was more frequently to the north and to the south of the central belt than upon it.

In Ireland the driest part relatively lay in the extreme west, the greater part of the counties of Galway, Clare, Limerick and Kerry having a deficiency of more than 20 per cent. The greater part of the north of Ireland and a patch in the south-west had less than 10 per cent. deficiency.

The foregoing discussion is, of course, preliminary and is liable to revision when the whole of the data are critically examined and worked up exhaustively for "British Rainfall, 1905."

COLDEST SPRING ON RECORD IN SOUTH AUSTRALIA.

By Sir Charles Todd, Government Astronomer.

The temperature conditions at the Adelaide Observatory (lat. 34° 56′ S., long. 138° 35′ E.) have been so remarkable and abnormal that the following brief analysis of the figures and comparison with the average for previous years may be of interest. In South Australia the year may be conveniently divided into two seasons—the summer months commencing with November and ending with March, and the autumn-winter-spring months (April to October), which may be termed the agricultural season, for then the crops are planted and come to maturity. The latter end of August, September and October constitute the spring portion of the year. In the following table are given the mean temperatures for the spring of this year :—

Mean Temperature Table.

1905.	Mean of Daily Maxima.	Average previous 47 years.	Mean of Daily Minima.	Average previous 47 years.	Mean Monthly Temp.	Average previous 47 years.	Highest Reading.	Lowest Reading.
	°	°	°	°	°	°	°	°
August.....	59·5	62·0	43·5	45·8	51·5 *a*	53·9	68·8	34·8
September	60·5	66·4	43·5	47·8	52·0 *b*	57·1	75·1	35·9
October ...	64·3	72·8	46·1	51·5	55·2 *c*	62·1	77·0	38·9

a. In previous years August mean temperature has only once been lower than this (viz., 49°·9 in 1872).
b. September mean is the record lowest. (Previous min. 53°·8 in 1874.)
c. October ,, ,, ,, (,, ,, 58°·4 ,, 1886.)

The departure from normal conditions shown by the above figures (especially during the day) is very marked, but the extraordinary

character of the season is perhaps more clearly seen in the following analysis of the daily maximum and minimum readings :—

Daily Maxima.—Number of Days the Maximum Reading of the Thermometer lay between—

	50°0 & 54°9	55°0 & 59°9	60°0 & 64°9	65°0 & 69°9	70°0 & 74°9	75°0 & 79°9	80°0 & 84°9	85°0 & 89°9	90°0 & 94°9	95°0 & 99°9	100°0 & 104°9	Highest.	On	Lowest.	On
August, 1905 .. .	4	15	9	3	...	...	...	...	...	...	...	68·8	4	50·1*a*	29
Aver. for August (47 years)	1·1	10·2	12·4	5·1	1·8	0·3	0·1	...	...	...	...	82·0	1862	49·5	1882
September, 1905.	2	14	10	3	...	1	...	...	...	...	...	75·1	12	53·7	7
Aver. for Sept. 47 years)	0·3	4·3	10·5	6·9	3·9	2·7	1·2	0·2	...	...	...	90·7	1882	51·0	1880
October, 1905.....	...	5	17	5	...	4	...	...	...	...	...	77·0*b*	5	38·0	30
Aver. for October (47 years)	...	0·9	5·2	8·0	6·0	3·7	3·3	2·3	1·2	0·3	0·1	100·5	1859	35·4	1898

a. Coldest day on record for the latter half of August.
b. Lowest monthly maximum on record for October.

Daily Minima.—Number of Nights the Minimum Reading of the Thermometer lay between—

	30°0 & 34°9	35°0 & 39°9	40°0 & 44°9	45°0 & 49°9	50°0 & 54°9	55°0 & 59°9	60°0 & 64°9	65°0 & 69°9	70°0 & 74°9	75°0 & 79°9	Warmest Night.	On	Coldest Night.	On
August, 1905	1	8	9	11	2	...	...	...	...	...	51·9	25	34·8*a*	21
Aver. for August (47 years)	0·1	3·3	9·7	12·5	4·4	0·8	0·2	...	...	...	65·1	1871	32·3	1839
September, 1905.	...	8	12	8	2	...	...	...	...	...	52·9	12	35·9*b*	28
Aver. for Sept. (47 years)	...	1·4	7·4	11·4	6·9	2·1	0·6	0·2	...	...	66·3	1873	32·7	1858
October, 1905.....	...	1	11	15	3	1	...	...	...	...	58·7*c*	10	38·9	20
Aver. for October (47 years)	...	0·4	3·9	9·7	9·1	4·5	2·2	1·0	0·2	...	77·0	1861	36·1	1858

a. Only once a colder night than this in August.
b. Coldest night on record for latter half of September.
c. Only once before in 47 years has the warmest night in October been under 60° (viz., 59°·4 in 1883).

Such a cold spring is unprecedented in the Observatory records ; the nearest approach to the present season being the year 1883 which previously held the record, being much lower than any other spring. This year (1905), however, completely eclipses 1883, as will

be seen from the following comparison of the mean temperature figures for the two years :—

	Mean Max.		Mean Min.		Mean Temp.		Highest Reading.		Lowest Reading.	
	1883	1905	1883	1905	1883	1905	1883	1905	1883	1905
Aug...	60°4	59°5	44°4	43°5	52°4	51°5	67°2	68°8	37°6	34°8
Sept...	62·6	60·5	46·3	43·5	54·4	52·0	76·3	75·1	40·9	35·9
Oct....	69·2	64·3	50·1	46·1	59·6	55·2	87·3	77·0	40·5	38·9

ON A SCHEME FOR THE CO-OPERATIVE STUDY OF BRITISH THUNDERSTORMS.

By L. C. W. Bonacina.

In studying any class of natural phenomena it is of paramount importance that not only the phenomena themselves may be investigated but also the physical circumstances that attend their manifestation; and it is further eminently desirable that all facts that can possibly have any bearing upon the phenomena in question be included in the study, in order that the science of these phenomena which it is proposed to establish may be made as wide as possible and to merge insensibly into the domain of kindred sciences.

Any proper and comprehensive scheme, therefore, for the study of thunderstorms must discuss the storms themselves or their purely meteorological aspect, their relation to time and locality; or their climatological aspect, the extent to which they are influenced by geographical and geological features, what influence they exert upon the living world wherein they have a physiological significance, and the all-important questions of their causes and connection with the general state of the atmosphere.

As three or four observers have already expressed themselves willing to furnish such notices as may be required respecting thunderstorms occurring in their own neighbourhoods, we venture to propose for the consideration of readers of this Magazine the following scheme for the co-operative study of thunderstorms.

We propose that the report of each thunderstorm observed be based upon certain lines of information, viz. :—

(1). Date, time, and locality of occurrence of storm; full statement as to geographical features of locality and its geological formation in the first report, and the apparent influence exerted by these upon the storm.

(2). Type of thunderstorm. (See Explanation).

(3). Intensity of thunderstorm.

(4). From climatological stations, readings of temperature and humidity before, during and after the storm; amount and character of precipitation; general state of the sky and appearance of clouds; force and direction of the wind.

(5). Show climatological stations, height of barometer on morning and evening of the day for which the storm is reported.

(6). Time of commencement and ending of thunder, rain, &c.

(7). Natural history notes; loss of life, damage to property, &c., affected by the storm.

Explanation:

(1). It is not merely the relation of thunderstorms to geographical *position* that we wish to ascertain, but also their relation to geographical *features*. We suggest, therefore, that the reporting stations as they increase in numbers shall be classified according to the natural conditions of the country, not to the political divisions like the shires. We do not want, for example, to compare the thunderstorms of the *county* of Cumberland with those of the *county* of Kent, or of the *county* of Devon with those of the *county* of Lincoln, because none of those counties represent physical wholes; but we do want to compare the storms of the Lake District with those of the Weald, of Dartmoor with those of the Fen country, and so on, because those areas are well-defined natural divisions. The number of stations required for each of these divisions would of course vary with its size. Ranges of hills, like the North Downs, which separate the Weald from the Lower Thames Valley, should be regarded as distinct divisions and accordingly supplied with observers.

In this way we should soon learn the influence which the physical features of the land exert upon the frequency, intensity and path of travel of thunderstorms. The investigations of the Thunderstorm Committee seem to show that the paths of storms are governed rather by the distribution of atmospheric pressure than by the configuration of the land. The subject is a most interesting one and deserving of careful study.

(2). By the *type* of thunderstorm we mean the type of weather during the prevalence of which the storm occurs, and of which it is a phase. There are many types of weather that in this country are liable to cause thunderstorms. A familiar type of thunderstorm is that which often occurs after a period of high temperature in summer. Another well-known type of storm is that associated with a stagnant and intensely gloomy state of the atmosphere and a temperature often below the normal; thunderstorms of this kind, which are probably the most violent that occur in Britain, are frequently developed in the space between two anticyclones. The Kentish hailstorm of September 10th, 1902, belonged to this type. Then there are the thunder showers that accompany cool, broken weather in summer, and those associated with rough cyclonic conditions in winter. As an example of a thunderstorm of a singularly eccentric nature, we

may mention the one which passed over the metropolitan district on January 23rd, 1895, and which was characterized by a heavy snowfall together with violent thunder and lightning.

There exists, of course, no line of demarcation between any of these different types of thunderstorms; they merge imperceptibly into one another, so that it is not possible to attempt any systematic classification of thunderstorms according to type. Nor, indeed, is it needful to do so. Let every observer under this heading give what information he cares as to the appearance of the storm he is reporting, and the *general type of weather* during the prevalence of which it occurs. Our own knowledge of the state of weather prevailing over the country as a whole would throw further light upon the type of individual thunderstorms.

(3). The intensity of thunderstorms should not, of course, be judged solely by their effects upon objects, as two storms of similar intensity would never wreak the same amount of damage even in the same locality. It will, however, be easily estimated as slight, moderate, or severe, by the observer, provided he has the ordinary experience of British thunderstorms.

For reporting purposes let us fix the minimum intensity of thunder and lightning—namely, distant thunder or sheet lightning without thunder, as constituting a "thundery" day. In referring to this question of the intensity of thunderstorm phenomena, we must not lose sight of the limit that is imposed upon us by the senses. If the nervous system were sufficiently sensitive, there would probably be few showery days when thunder and lightning would not be perceived by it.

(4). Here we require a knowledge of the atmospheric conditions accompanying the storms reported.

Temperature:—Reports received from observers in possession of climatological stations should contain temperature readings taken before, during and after the storm, whilst a copy of the thermograph's record would be invaluable, and indeed essential to any investigation into many complex physical problems connected with thunderstorms.

Humidity:—Readings of the wet bulb thermometer should be inserted. Theoretically, a low relative humidity combined with a high absolute humidity at the surface of the Earth should represent the conditions most favourable to thunderstorm development.

Precipitation:—The character, duration, and amount of precipitation that occurs in a thunderstorm should be noted. When hail characterizes a thunderstorm, we would urge that a note be made of the directions of motion of the upper and lower clouds of the storm, together with a note upon the localization of the hail in the district reporting it. (See Abercromby in "Weather," pp. 288—291). It should be borne in mind that hail exhibits a tendency to fall in parallel bands on either side of the central area of the storm where often rain alone falls.

Clouds, Wind, &c. :—Close observations upon the direction and force of the wind, of the forms, changes and movements of the clouds, together with notices of the occurrence of globular lightning, St. Elmo's Fire, and Aurora should form a feature of every thunderstorm report.

(5). Barometric readings, taken morning and evening, for the thundery days must be entered in the reports. Copies of the barometric traces, showing the oscillations so characteristic of thundery weather, would be of the greatest value as these oscillations appear to be the visible effect of a series of atmospheric waves, and to be in some way connected with lightning strokes (Thunderstorm Committee Report). When it will be desired to make a minute study of the distribution of atmospheric pressure during any thundery period, it will be necessary to obtain barometric readings for that period from as many meteorological stations as possible, in order that charts may be constructed showing differences of pressure for hundredths of an inch. The frequent thunderstorms of the month of June, 1888, were thus studied in relation to the accompanying distribution of pressure by Mr. William Marriott in his discussion of the observations of the Thunderstorm Committee, and submitted to this process of analysis they yielded some important knowledge, such as that thunderstorms are comparable to miniature cyclonic systems.

Thnnderstorms, as is well known, are the accompaniment of certain types of distribution of atmospheric pressure. It must not be forgotten that often in summer, when the distribution of pressure is favourable to the development of thunder and lightning, that this very distribution has itself been brought about in great measure by the effects of strong solar radiation over the land, which tends to keep atmospheric pressure relatively low over the land and to give rise to local convection currents resulting in rapid condensation of aqueous vapour and increased electrical density.

Let us turn to the Weather Chart issued for 8 a.m. on July 9th, 1905, a date, it will be remembered, when thunderstorms were very general over Great Britain. England and the north of France lay in the space between two high pressure systems, and, as had consequently been anticipated, thunderstorms developed early in the day in many localities. Now the precise distribution of atmospheric pressure that prevailed on that morning favourable to the formation of thunderstorms was, of course, the result of those unknown laws regulating the sequence of changes in the distribution of pressure from day to day and from minute to minute, modified by the disturbing effects normal to the season of strong solar radiation over England, and there can be but little doubt that the weakening of the anticyclone over England that had set in since 8 a.m. on the previous morning was to some extent, to what extent we cannot say, due to the high temperature that had prevailed over the country during the ensuing day, July 8th. The important point to be

remembered is that though the thunderstorms of July 9th would not have occurred had not the distribution of pressure been favourable, the fact that this was favourable must *in this case* be largely attributed to effects of previous hot weather.

To the discussion of such highly interesting questions we hope to devote a future article.

(6). We require to know the time of commencement and ending of thunder, rain and hail, in order that the paths and rate of travel of storms may be ascertained in accordance with the method employed in the discussion of the observations made under the direction of the Thunderstorm Committee.

(7). Observers interested in any branch of natural history would do useful work by supplying short notes concerning any phenomena that they can clearly associate with thundery conditions of the atmosphere. Information as to loss of human life, damage to buildings, cattle, &c., and the circumstances attending the catastrophes might also be added. Of the great forest trees the oak appears to be the most susceptible of lightning stroke, but in most parts of England the oak is the predominant tree, so that on that account alone more instances of injury to this than to less abundant species like the elm, beech and ash, are on record.

The main object of this scheme of study will be fourfold: to determine (1) the geographical and seasonal distribution of thunderstorms over the British Islands; (2) the close relation of thunderstorms to the distribution of atmospheric pressure; (3) the close relation of thunderstorms to atmospheric conditions; (4) the exact causes of thunderstorms.

By studying the geographical and seasonal distributions of thunderstorms together, curious tendencies towards thunderstorm development in certain localities at certain periods of the year, such as that observed by Dr. Mill towards the occurrence of storms in the south-east of England during the last week of July, will be discovered.

Paragraphs 6 and 7, therefore, in accordance with the main object of the scheme as stated above are of lesser importance, but references to them in the reports should never be omitted. To all who volunteer their assistance as observers type-written forms, giving details as to the manner in which it is desired that the reports be drawn up, will be sent, in order that they may be spared unnecessary trouble and expenditure, and we unnecessary labour in interpreting the reports.

We trust that the method of study here laid down may meet with such criticism as may enable defects in it to be remedied and omissions in it to be supplied. During the next few months thunderstorm work will be light, and there will be ample time for fresh suggestions to be received before storms increase again in frequency in the spring.

Let us conclude with the hope that the poetry of thunderstorm phenomena, whether expressed in verse, prose or art, may not be altogether neglected by those who would advance the science of them.

Despite all that is sometimes said to the effect that science is opposed to poetry, we maintain that it is largely the poetic expression of any object or phenomenon, of any land or sea-scape, of any quiet rural scene, that inspires a scientific interest in it and prevents such interest from flagging.

[We gladly publish the above article, and commend it to the attention of observers who are specially interested in thunderstorms; for we consider that the best way to revise and improve such a scheme is to give it a trial that will reveal its weak points and suggest modifications. Observers desirous of taking part should communicate with Mr. Bonacina, at 2, Greencroft Gardens, London, N.W.—Ed. *S.M.M.*]

Correspondence.

THE HIGH BAROMETER IN DECEMBER.

To the Editor of Symons's Meteorological Magazine.

You will, no doubt, be receiving notices of the high barometric readings of the early part of this week, which I think were quite abnormal. I was at Cardiff, on business, and had my pocket aneroid with me. I noticed its rise on Monday the 11th, and wondered if it had "gone wrong." On Tuesday morning, 12th, at 8 a.m., the needle had gone beyond scale, and was equivalent to *31·12*, as near as I could judge without the scale under it. This was at 40 ft. above sea level.

On my return to London on Wednesday, and on each day since, I have compared the aneroid with my Negretti and Zambra mercurial, and find a constant index error of + ·12, which would make the Cardiff reading 31·00, subject to correction for 40 ft. above sea level. From the *Times* chart of Wednesday it would seem that the centre of the anti-cyclone was over Cardiff. I shall be interested to see if my readings are confirmed, and whether you will tell us next month that the 12th of December, 1905, is comparable with January 18th, 1882. (See *Symons's Met. Mag.*, 1882, p. 8).

JAMES G. WOOD.

7, New Square, Lincoln's Inn, W.C., December 16th, 1905.

For the second time this year, and the fifth since my record commenced in 1878, the barometer has exceeded 30·900; on December 12th, at 10.30 a.m., it attained the height of 30·937, corrected and reduced.

Two points may be noticed—(1.) The rise was unsteady. From 1.30 a.m. to 3 a.m., a rise of 0·070; a very slow rise for the next four hours; steady for two hours from 7 a.m. to 9 a.m., and then a rapid rise from 9 a.m. till 10.30 a.m., also of 0·070. (2.) Some time during the early morning hours of the 12th, while the barometer was above 30·800, there was a slight *shower of rain* (·02 in.).

CHARLES L. BROOK.

Harewood Lodge, Meltham, December 18th, 1905.

[At Camden Square the highest pressure occurred at 10.15 a.m., when the barometer read 30·873 inches, practically identical with that of January 15th, 1902, which was 30·874; but exceeded by January 28th, 1905, with 30·955, by January 9th and 30th, 1896, with 30·934 and 30·927; and by the still unsurpassed reading of January 18th, 1882, which was 30·975 inches. The isobar of 30·90 in. for 6 p.m. on 12th includes the west of Wales and the east of Ireland; but we have not seen any instance of 31·00 inches being observed with verified barometers.—ED. *S.M.M.*]

GREEN FLASH AT SUNSET.

I WOULD call attention to a phenomenon of atmospheric refraction frequently observed, but of which very little has been published. I refer to the green flash seen in clear weather as the last ray of the setting sun disappears. I observed this one evening in the North Atlantic, last month; I also saw it in the North Atlantic in October, 1898; on that last occasion I watched Venus setting a little later, but though the planet turned red occasionally it did not flash green at the last moment; I have, however, seen a planet flash green at setting.

The phenomenon is noticed in *Knowledge*, April, 1889, p. 126, where the colour is given as blue; also in *Nature*, March and April, 1890, pp. 495, 538, and in the Royal Astronomical Society's Notices, May, 1901. In these notices the writers appear to hold different views as to the cause. In "Elementary Meteorology," by Prof. W. M. Davis, p. 50, it is stated that after sunset every solar beam will be broken up into a short vertical spectrum; is this the explanation? if so why should the last flash be green? (according to some accounts of a remarkably vivid green). I would like to see that matter worked out.

J. P. MACLEAR.

Chiddingfold, December 19th, 1905.

[The beautiful phenomenon described by Admiral Maclear is very familiar to those who are on the watch when the sun sets, either on a sea horizon, or a straight strip of low land. We hope to publish an article upon it in an early number.—ED. *S.M.M.*]

CURIOUS EFFECT OF LIGHTNING.

A SIMILAR case to that reported by Mr. Haes was observed by me at Cranleigh in 1889. (*Quarterly Journal R.Met.Soc.*, Vol. **16**, p. 229.) A tall tree stood over the gable end of a stable, the gable was struck, but there was no mark on the tree. I believe myself that the upper branches of the tree were highly charged, and when discharged suddenly the lightning preferred the warm moist air from the chimney to the trunk of the tree.

Warm air was probably coming up the chimney in the case related by Mr. Haes, although no fire was alight.

J. P. MACLEAR.

Beaconscroft, Chiddingfold, 20th December, 1905.

THE RAINFALL OF ENGLAND AND THE SOUTH-EAST TRADES.

IF an unknown writer were to assert that there was any connection between the South-East Trade Winds in the South Atlantic and the rainfall of the south of England, we should be inclined to examine his arguments with the same sort of interest as would attach to a homily on Tenterden Steeple and the Goodwin Sands. But when the Director of the Meteorological Office seriously propounds the coincidence in the pages of *Nature*, we feel that the matter is much more than a scientific curiosity. Dr. W. N. Shaw, writing on "The Pulse of the Atmospheric Circulation," in *Nature* for December 21st, 1905, shows that the average curve of the mean monthly velocity of the wind at St. Helena for 1892—1903 is almost exactly similar to the curve of monthly incidence of rainfall for "England South" for 1866—1900. The resemblance in the two curves is certainly exceptional, and in one or two instances of individual years there are also indications of the same relationship. Dr. Shaw feels that the accordance cannot be altogether accidental. He says, "The fact that a seasonal variation of rainfall does show itself in the average of a few years has a meaning, and that its phases are closely similar to those of the arterial pulsations of the general atmospheric circulation accords too much with what may be called common sense to be altogether devoid of significance." The importance of such a relationship, if it can be established and extended, on practical problems of weather prediction can hardly be exaggerated.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1904.

Stations. *Those in Italics are South of the Equator.*	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Min.	Mean.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Rainfall. Depth.	Rainfall. Days.	Average. Cloud.
	°		°		°	°	°	°	%	°	°			0—10
London	91·0	August 4	24·1	November 26	58·1	43·2	50·6	45·0	85	135·9	16·5	2 65	160	6·2
Cape Town	100·5	January 23	36·9	July 21	69·4	53·9	61·6	52·9	73	...	...	31·82	112	4·7
Durban	101·1	September 3	48·8	June 28	79·4	61·5	70·4	...	...	159·2	...	34·72	141	4·1
Mauritius	89·9	February 22	50·9	Sept. 21	80·4	66·0	73·2	64·1	75	155·2	42·0	43·12	210	6·1
Calcutta	101·5	April 23	47·0	February 2	87·1	70·5	78·8	68·9	74	163·2	40·4	63·20	82	4·2
Bombay	94·7	March 30	62·3	January 19	86·7	75·5	81·1	71·7	75	141·2	56·5	33·42	90	3·7
Madras	103·5	June 3	61·2	February 1	91·4	74·3	82·9	69·8	71	161·2	56·4	18·15	78	4·3
Kodaikanal	77·3	April 6	39·9	January 7	64·3	50·3	57·3	47·8	72	146·2	23·4	46·62	148	4·9
Colombo	92·7	February 25	65·0	Feb. 3, 4	86·1	75·2	80·7	71·8	79	157·7	59·2	76·62	162	5·8
Hong-Kong	91·1	June 26	44·8	December 24	76·5	67·9	72·2	62·7	77	149·6	...	80·44	137	6·5
Melbourne	102·0	December 24	31·5	July 23	68·8	46·8	57·8	47·9	73	160·2	26·6	29·72	128	5·9
Adelaide	114·0	December 31	36·9	May 24, July 29	72·2	52·9	62·5	47·8	61	161·0	29·7	20·29	117	4·6
Coolgardie	108·6	December 27	32·0	July 14	76·3	52·0	64·1	46·1	54	180·5	23·5	11·77	72	3·8
Sydney	107·5	December 31	39·5	June 30	69·7	56·1	62·9	52·3	73	138·1	29·1	45·95	216	4·9
Wellington	82·3	January 21	32·0	July 3	60·9	48·0	54·5	44·5	67	140·0	29·0	60·41	170	6·4
Auckland	79·5	February 18	37·0	July 23, Aug. 5	63·4	52·5	58·0	50·4	76	148·0	29·0	45·70	175	5·4
Jamaica	89·9	July 8, Aug. 5, Sept. 4	63·8	January 7	85·5	71·3	78·4	71·5	78	...	...	64·20	101	...
Trinidad	91·0	May 13	61·0	Feb. 24, 25, 26	86·1	68·4	77·3	72·0	82	167·0	58·0	56·43	188	...
Grenada	91·4	October 31	68·4	Feb. 22, Jun. 7	82·9	73·3	78·1	70·2	75	156·2	...	69·75	254	3·6
Toronto	93·0	July 18	— 15·1	January 4	51·2	33·9	42·6	37·0	79	122·7	—18·2	35·71	151	6·0
Fredericton	86·1	July 20	— 35·0	February 6	49·9	27·4	38·7	27·1	58	...	...	41·46	116	5·5
Winnipeg	89·0	June 18	— 42·0	January 24	...	...	...	...	...	...	...	22·86	113	5·3
Victoria, B.C.	82·3	July 21	24·5	February 8	56·0	44·7	50·4	...	...	...	...	26·59	152	6·2
Dawson	80·0	August 9	— 57·8	January 14	30·8	13·0	21·9	...	...	...	...	12·04	74	4·7

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, December 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. G. C. Simpson gave an interesting account of his "Attempt to fly Kites for meteorological purposes from the mission ship attached to a deep-sea fishing fleet in the North Sea." These observations, which were made in July and August last, were carried out on behalf of the joint Kite Committee of the Royal Meteorological Society and of the British Association. By the kindness of the Royal National Mission to Deep-Sea Fishermen, the kites were flown from the deck of the mission-ship *Queen Alexandra*, attached to the Red Cross Fleet. Owing to the vessel being almost continuously employed in trawling, the opportunities for flying kites were very limited; nevertheless, Mr. Simpson was able to secure eight ascents without damage to kites or meteorographs during the time he was on board. The greatest height reached by the kites was 5800 feet.

Mr. C. J. P. Cave described his method of flying kites in Barbados in April and May last year, and Mr. W. H. Dines, who had examined the records, said that the humidity traces show generally a value of about 60 per cent. at the surface, rising to 80—90 per cent. at heights of 1000 to 2000 feet, and then falling off again in some cases to 50 per cent. or less as the height increases. These values are lower than might have been expected over a tropical ocean. The increase is of the ordinary kind, but the maximum value occurs at a far lower elevation than is the case in Europe. It is probable that the relative humidity forms an extremely accurate index to the vertical circulation, a low humidity indicating a descending current of air, and so it may be inferred that there is some settling down of the atmosphere over the region of the smaller West Indian Islands in April and May.

Mr. W. H. Dines, F.R.S., read a brief paper on "Temperature changes during the partial solar eclipse of August 30th, 1905, on the surface and at 3000 feet at Oxshott." The under surface of the cloud layer, which in the neighbourhood of London completely obscured the sky, was 2000 feet high. It seems probable that the kite was above the clouds, and that the cloud layer was only a shallow one, for the occupants of a balloon which ascended from London at 12.30 had a clear view of the eclipse; and also when the kite was drawn in at 4.28, and had just passed through the same clouds, it was not at all wet, as it certainly would have been had the descent through the clouds occupied any appreciable time. A trifling rise of temperature occurred as the shadow passed off, but Mr. Dines hardly thinks this was caused by the eclipse, especially as the same temperature was found at 3500 feet elevation at 4.28 as at 1.25 p.m. A meteorograph, which was suspended in a tree from 11.40 a.m. to 4.40 p.m., showed little or no change.

An interesting discussion followed the reading of these papers, in which the President, Dr. W. N. Shaw, Mr. E. S. Bruce, Mr. G. C. Simpson and Mr. W. H. Dines took part.

In the absence of the authors, the following papers were briefly presented by the Secretary :—

"Comparison between Glaisher's Factors and Ferrel's Psychrometric Formula," by J. R. Sutton, of Kimberley; and "A Rapid Method of Finding the Elastic Force of Aqueous Vapour and the Relative Humidity from Dry-bulb and Wet-bulb Thermometer Readings," by Dr. J. Ball, of Cairo.

Dr. W. N. Shaw called attention to the great importance of hygrometric observations in this country, and deplored the neglect which has hitherto prevailed.

The following were elected Fellows of the Society :—Mr. W. S. Clark, Rev. D. Kennedy, D.D., Mr. J. Lyle, M.A., Mr. W. J. Marriott, Mrs. E. V. Pereira, Mr. J. M. Phillpott, Mr. C. Salter, Mr. A. C. Saxby, Mr. H. T. Scoble, Mr. R. Shastri, and Rev. H. Vaughan.

THE INVESTIGATION OF THE UPPER AIR.

THE Meteorological Office has issued the following communication to the press, and we publish it with a feeling of gratification that this country is at last taking its proper share in one of the most promising fields of Meteorological research.

In response to representations which have reached them from various quarters, the Meteorological Committee have assigned from the Parliamentary grant under their control a sum for promoting the investigation of the upper air by kites and other means.

The immediate objects in view are :—

1. To establish an experimental station where kite ascents and other experimental investigations can be carried out, especially on the days selected for international co-operation.

2. To develop and extend the instrumental equipment, so that facilities may be afforded for the co-operation of other observers upon sea or land.

3. To provide for the publication of the observations in combination with those of other countries by a contribution to the cost of the internationa. publication undertaken by the president of the International Commission for Scientific Aerostation, Professor H. Hergesell, of Strassburg.

Mr. W. H. Dines, F.R.S., who is well known for the work he has done in connexion with a joint committee of the Royal Meteorological Society and the British Association, has undertaken the direction of the operations for the Meteorological Office. His experiments for the office are carried on at his house at Oxshott.

An endeavour will be made, with fair prospect of success, to enlist the co-operation of marine observers in correspondence with the office. Captain A. Simpson, of the steamship *Moravian*, an observer of long experience, has already expressed his willingness to make a trial of this method of extending

our knowledge of marine meteorology as soon as the necessary gear and instruments can be supplied.

It is hoped that through the asssistance of others who are interested in such investigations, and have at their disposal the means of carrying them out, an effective scheme for the investigation of the upper air may be set on foot. Lieutenant-Colonel J. E. Capper, C.B., R.E., of the Aldershot balloon companies, has already facilities for such purposes, and will take part; Mr. G. C. Simpson, Lecturer on Meteorology in the University of Manchester, is making arrangements for occasional observations on the Derbyshire hills; Mr. C. J. P. Cave, who has already made some interesting kite ascents in Barbados, has provided himself with the necessary equipment for experiments at Ditcham Park; and Mr. S. H. R. Salmon has arranged a station on the Downs, near Brighton, and carries out ascents on the International days.

There is, accordingly, a prospect of an effective investigation being commenced.

METEOROLOGICAL NEWS AND NOTES.

Miss Jessie Hill Buchan, for many years the right hand of her uncle, Dr. Alexander Buchan, in the office of the Scottish Meteorological Society, died suddenly on December 7th, to the profound regret of all who knew her, and greatly to the loss of meteorology in this country. Miss Buchan began to work at the Scottish Meteorological Society in 1868, and was Dr. Buchan's sole assistant until 1886. She had charge of the finance of the Society as Treasurer's clerk, and received all the subscriptions for the Ben Nevis Observatory. A large part of the regular work of the office, including the checking of the returns from the Society's stations, fell to her share, and she also did an immense amount of tabulating and computing for the many large and important papers published by Dr. Buchan, especially with reference to his Report on Atmospheric Circulation in the *Challenger* Reports. She was an unfailing helper and friend to all who had occasion to visit the Society's rooms, and her cheerful presence will be sorely missed.

The Climatological Summary for the British Empire in 1904 is published on another page, and this year we have endeavoured to disarm the criticism which has annually fastened upon this harmless and even official set of figures by refraining from stating in words that Dawson is cooler than Madras, or Coolgardie less humid than Colombo. The Table is there to speak for itself and it presents some features of real interest.

The Royal Meteorological Society has arranged for lectures on a meteorological subject by Mr. W. Marriott, in connection with the work of the local Scientific Societies Committee, on the following dates, at the places mentioned:—January 16th, at Sidcup, to the Literary and Scientific Society; January 23rd, at London, in Exeter Hall, to the Young Men's Christian Association; January 24th, at

Epsom, to the Epsom and District Literary and Scientific Society; February 2nd, at Harpenden, to the Social Union; February 8th, at Reading, to the Natural History Society; February 9th, at Bishop Stortford; February 10th, at Woolwich, to the Royal Arsenal Co-operative Institute; February 24th, at Colchester, one of the Essex Education Committees' Market day lectures; February 28th, at Nantwich; March 2nd, at Derby, to the Municipal Training College; and March 14th, at Doncaster, to the Scientific Society. We hope that all meteorological observers will make an effort to attend the lecture in their neighbourhood.

DR. H. R. MILL HAS ARRANGED TO LECTURE for the Gilchrist Educational Trust, on the subject of "Rain," at Dolgelly, on Wednesday, 14th February; at Portmadoc on Thursday, 15th February; at Holyhead on Friday 16th February; at Worcester on Monday, 12th March; and at Bridgnorth on Tuesday, 13th March. He has also arranged to give a lecture on a similar subject to the Royal Dublin Society, on the afternoon of Wednesday, March 7th.

SOLAR AND CLIMATIC VARIATIONS are discussed by Dr. C. Easton, of Rotterdam, in the August, 1905, number of *Petermanns Mitteilungen*. He shows a remarkable correspondence between the curve of solar activity and the curve of cold winters, and points out the probability of periodic variations of different duration existing, especially the familiar eleven-year sunspot period, and a period including eleven sunspot cycles, or 178 years.

"IRELAND IS ENGLAND'S UMBRELLA," lamented a resident in Donegal, complaining of interminable rains and floods during December. "I wish they would make holes in it," is the despairing comment of the rainfall observer in the drought-distressed Eastern Counties, who forwards the note to us.

REVIEWS.

Proceedings of the Third Convention of Weather Bureau Officials, held at Peoria, Ill., September 20, 21, 22, 1904. Washington: 1904. Size, $9\frac{1}{2} \times 6$. Pp. 268.

THE practice of holding a three-yearly Convention of the Weather Bureau officials, who are scattered all over the United States in the local weather offices, affords an opportunity for the discussion of meteorological questions by a body of specialists similarly trained but accustomed to work with very different types of climate. This compact volume contains a number of important papers and discussions, but the most remarkable thing in it is the incidental recommendation by Professor Willis Moore in his "Letter of Transmittal," that 5000 copies should be printed. This gives some idea of the extent to which meteorology, and that not of a popular or elementary character, is expected to be appreciated on the other side of the Atlantic.

Seasons in the British Isles from 1878. By W. N. SHAW. Reprinted from the Journal of the Royal Statistical Society. London: 1905. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 98.

THIS paper is a summary of the *Weekly Weather Report* of the Meteorological Office since the commencement of that publication, with certain deductions and applications. Dr. Shaw gives a clear statement of the object with which the *Weekly Weather Report* was founded; the treatment of weather on the basis of the week as a unit of time and the district as a unit of area mainly in the interest of agriculture. He then gives a table running to 25 pages, showing each county in the British Isles divided according as its mean annual rainfall is above or below 35 inches, with the agricultural characteristics of each division and the meteorological averages for the corresponding stations. He then deals with the succession of the seasons and gives a number of suggestive instances of the application of the data collected to practical ends. The whole paper is a fine instance of the statistical treatment of observations and the scientific attitude with regard to their ultimate utility.

The Bahama Islands. Edited by GEORGE BURBANK SHATTUCK, PH.D. New York and London: Macmillan. 1905. Size $10\frac{1}{2} \times 7\frac{1}{2}$. Pp. xxxii.+630.

THIS beautiful volume is published by the Baltimore Geographical Society and records the researches made and conclusions drawn by an expedition of scientific specialists who visited the islands in 1903. As is well known, the meteorology of the West Indies receives much attention from the Weather Bureau in Washington, and it will not surprise our readers so much as it would astonish the general public to find an important British possession on the verge of the tropics waiting for an adequate scientific description until our American cousins found leisure to take it up. Every aspect of the physical geography of the Bahamas is dealt with in a comprehensive way, earlier records being consulted to support the observations of the expedition, which extended over only five weeks in the islands.

Our concern here can only be the Magnetic and Meteorological chapters, of which there are three, written by the competent hand of Dr. Oliver L. Fassig, who was in charge of that department of the expedition. They deal with Magnetism, Climatology, and Kite Observations. The following summary of the absolute extremes of air temperature at Nassau is interesting in showing how the year of absolute minimum in six months (1869) was followed by the year of absolute maximum in four months (1870).

Extremes at Nassau, New Providence, from 1853 to 1902.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Min.....	49°	53°	49°	54°	61°	63°	66°	66°	64°	63°	58°	48°*
Year.....	1866	1865	1869	1869	1869	1869	1885	1869	1869	1857	1865	1868
Date.....	10	2	2	16	23	12	23	2	7	28	...	25
Max.	96	97	91	96	100	102	106	99	109	96	99	97
Year..... ...	1871	1871	1856	1872	1856	1870	1870	1871	1870	1872	1877	1870
Date.....	28	16	14	10	10	21	14	2	27	2	8	22

Perhaps the most interesting section is that on the hurricanes for which the West Indies are famous. Two discussions of the frequency of hurricanes in the West Indies in different months are given. These refer to the periods 1493—1855 and 1878—1900. In order to show the monthly frequency together, we have prepared the following table, covering 386 years, though leaving 24 years out of account, from 1856 to 1877.

Frequency of Hurricanes.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
No.	8	7	11	6*	6*	13	45	**121**	105	101	20	10	453
Per cent.	2	1·5	2·5	1·5	1·5	3	10	27	23	22	4	2	100

It is seen that 72 per cent. of the hurricanes occur in the three months August to October. Charts are given showing the tracks of all important hurricanes from 1878 to date.

Five kite ascents were made, the highest reaching 3858 feet, and the mean rate of decrease of temperature observed was 6°·1 per 1000 feet.

Report on the Climate and Weather of Baltimore and vicinity. By Oliver L. Fassig. Baltimore: The Johns Hopkins Press, 1904, 1905. Size $10\frac{1}{2} \times 7\frac{1}{2}$. Pp. (282). Plates.

This deals with the climate of Baltimore, the final instalment being reserved for the weather. The discussion is unusually full and minute, the diurnal variations of the various climatic elements being treated as well as the monthly and annual. A special feature is a series of diagrams combining in one figure the normal diurnal and monthly variations for a whole year. The discussion is so thorough and so full of interest that we greatly regret our lack of space in which to give an epitome of the mode of treatment at least. The memoir may well serve as a pattern for the complete study of the climatological record of a long-established station.

Les gradients verticaux de la Température dans les minima et les maxima barométriques. [Vertical gradients of temperature in barometric maxima and minima]. By S. Grenander. Upsala: (London, Wm. Wesley & Son), 1905. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 16. Plates.

An extract from the mathematico-physical department of the Swedish Academy of Sciences. The author has studied the temperature records of a number of recent kite and balloon experiments and finds confirmation of the law enunciated by M. Teisserenc de Bort to the effect that the fall of temperature with height above a barometric depression is more rapid than above an anticyclone up to the elevation of about 13,000 to 16,000 feet, above which the relation is inverted.

RAINFALL AND TEMPERATURE, DECEMBER, 1905.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1870-99.	Greatest in 24 hours. Depth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Dat
		inches	inches.	in.						
I.	London (Camden Square) ...	·74	— 1·38	·17	7	7	57·1	7	29·2	1
II.	Tenterden ...	·73	— 2·01	·21	5	15	53·5	7	24·5	1
,,	Hartley Wintney ...	·71	— 1·84	·18	7	11	55·0	6, 7	24·0	1
III.	Hitchin ...	·78	— 1·27	·25	7	9	55·0	7	28·0	1
,,	Winslow (Addington) ...	·90	— 1·37	·37	7	13	55·0	7	26·0	1
IV.	Bury St. Edmunds (Westley)	·73	— 1·38	·23	7	9	56·0	7	27·5	1
,,	Brundall ...	1·15	— ·98	·34	29	16	55·4	7	28·4	1
V.	Alderbury ...	·78	— 2·04	·29	5	8	56·0	7	26·0	10,
,,	Winterbourne Steepleton ...	1·25	— 2·88	·29	5	15	53·5	7	24·0	1
,,	Torquay (Cary Green) ...	1·01	— 2·45	·24	27	9	54·5	1	33·8	1
,,	Polapit Tamar [Launceston]	1·54	— 2·85	·29	7	15	53·6	7	21·0	
,,	Bath ...	·93	— 1·83	·33	7	11	54·6	7	27·0	1
VI.	Stroud (Upfield) ...	·70	— 1·78	·34	7	10	54·0	7, 8	29·0	1
,,	Church Stretton (Woolstaston)	·76	— 2·16	·26	29	11	51·0	6, 7	25·0	3
,,	Bromsgrove (Stoke Reformatory)	·65	— 1·30	·21	7	6	52·0	7	23·0	2
VII.	Boston ...	·43	— 1·36	·22	28	5	52·0	7	29·0	1
,,	Worksop (Hodsock Priory).	·43	— 1·59	·21	28	10	56·5	7	27·2	1
,,	Derby (Midland Railway)...	·63	— 1·65	·27	28	15	54·0	7	28·0	10,
VIII.	Bolton (The Park) ...	·78	— 3·41	·13	19	14	50·5	6	30·8	3
IX.	Wetherby (Ribston Hall) ...	·40	— 1·79	·13	28	10	...	...	...	...
,,	Arncliffe Vicarage ...	4·36	— 2·05	1·06	20	17	...	...	...	...
,,	Hull (Pearson Park) ...	·41	— 1·95	·19	28	9	52·0	7	30·0	3
X.	Newcastle (Town Moor) ...	·46	— 2·18	·12	25	12	...	...	...	...
,,	Borrowdale (Seathwaite) ...	11·01	— 3·69	2·20	20	15	52·1	6	29·1	30
XI.	Cardiff (Ely) ...	2·19	— 2·24	·59	7	17	...	...	...	...
,,	Haverfordwest (High St.)...	1·74	— 3·48	·38	5	13	53·3	7	29·1	10
,,	Aberystwyth (Gogerddan)..	1·62	— 2·87	·30	7	10	52·0	7, 25	25·0	24
,,	Llandudno ...	·41	— 2·54	·15	20	10	55·0	2	35·0	31
XII.	Cargen [Dumfries] ...	2·02	— 2·66	·68	5	12	52·0	2	28·0	13,
,,	Lilliesleaf (Riddell) ...	·87	— 2·31	·32	25	12	50·0	6	25·0	26,
XIII.	Edinburgh (Royal Observy.)	1·27	...	·31	25	14	53·2	7	27·0	24
XIV.	Colmonell ...	3·81	— 1·01	1·12	24	18	52·0	3	28·0	11
XV.	Tighnabruaich ...	4·46	— 1·87	·67	24	18	46·0	3, 4	28·0	30
,,	Mull (Quinish) ...	5·37	— 1·11	·85	5	22	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	1·25	— 1·48	·35	24	15	52·3	3	31·2	12
XVII.	Braemar ...	2·02	— 1·13	·68	5	17	50·8	4	20·2	30
,,	Aberdeen (Cranford) ...	·94	— 2·45	·21	16	16	53·0	3, 4	23·0	12
,,	Cawdor (Budgate) ...	1·24	— 1·29	·36	7	11	...	...	...	...
XVIII.	Invergarry ...	6·29	— ·38	1·80	6	10	...	...	...	...
,,	Bendamph ...	9·36	+ ·32	1·83	5	26	...	...	...	...
XIX.	Dunrobin Castle ...	1·67	— 1·72	·33	6	14	56·0	2	28·5	7
,,	Castletown ...	2·04	...	·34	29	22	53·0	2	26·0	26,
XX.	Killarney ...	5·38	— 1·26	1·28	25	19	56·0	7	33·0	1
,,	Waterford (Brook Lodge)...	1·86	— 2·45	·40	27	14	54·0	25	26·0	1
,,	Broadford (Hurdlestown) ...	1·85	— 1·52	·32	24	20	60·0	4	30·0	
XXI.	Carlow (Browne's Hill) ...	1·93	— 1·53	·36	18	18	...	...	...	...
,,	Dublin (Fitz William Square)	1·26	— 1·13	·27	18	13	55·6	25	34·0	1
XXII.	Ballinasloe ...	2·44	— 1·19	·51	24	21	...	...	...	...
,,	Clifden (Kylemore House)..	6·04	— 2·95	1·36	18	17	...	...	...	...
XXIII.	Seaforde ...	2·89	— ·75	·71	18	18	51·0	2, 25	30·0	
,,	Londonderry (Creggan Res.)	2·83	— 1·48	·68	24	21	...	...	...	...
,,	Omagh (Edenfel) ...	3·39	— ·38	·60	24	22	52·0	2	33·0	

† Shows that the fall was above the average; — that it was below it. a and 11 31

SUPPLEMENTARY RAINFALL, DECEMBER, 1905.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	·76	XI.	New Radnor, Ednol	1·35
,,	Ramsgate, West Cliff	·25	,,	Rhayader, Nantgwillt	2·26
,,	Hailsham	1·15	,,	Lake Vyrnwy	1·42
,,	Crowborough	1·28	,,	Ruthin, Plâs Dràw	·61
,,	Osborne	·84	,,	Criccieth, Talarvor	1·20
,,	Emsworth, Redlands	·73	,,	Anglesey, Lligwy	1·05
,,	Alton, Ashdell	·85	,,	Douglas, Woodville	1·74
,,	Newbury, Welford Park	1·34	XII.	Stoneykirk, Ardwell House	1·23
III.	Harrow Weald	·96	,,	Dalry, Old Garroch	6·14
,,	Oxford, Magdalen College	·84	,,	Langholm, Drove Road	3·29
,,	Banbury, Bloxham Grove	·98	,,	Moniaive, Maxwelton House	3·61
,,	Pitsford, Sedgebrook	·78	XIII.	N. Esk Reservoir [Penicuick]	2·80
,,	Huntingdon, Brampton	·95	XIV.	Maybole, Knockdon Farm	3·54
,,	Wisbech, Bank House	·68	,,	Glasgow, Queen's Park	3·38
IV.	Southend	·57	,,	Campbeltown, Redknowe	3·17
,,	Colchester, Lexden	·61	XV.	Inveraray, Newtown	7·66
,,	Saffron Walden, Newport	·77	,,	Ballachulish House	8·19
,,	Rendlesham Hall	1·04	,,	Islay, Eallabus	4·28
,,	Swaffham	·92	XVI.	Dollar	3·70
,,	Blakeney	·90	,,	Loch Leven Sluices	3·18
V.	Bishops Cannings	1·09	,,	Balquhidder, Stronvar	7·66
,,	Ashburton, Druid House	1·87	,,	Coupar Angus	1·54
,,	Okehampton, Oaklands	1·85	,,	Blair Atholl	2·30
,,	Hartland Abbey	1·32	,,	Montrose, Sunnyside	1·45
,,	Lynmouth, Rock House	1·69	XVII.	Alford, Lynturk Manse	·75
,,	Probus, Lamellyn	1·99	,,	Keith	·83
,,	Wellington, The Avenue	·97	XVIII.	N. Uist, Lochmaddy	3·74
,,	North Cadbury Rectory	·90	,,	Aviemore, Alvey Manse	1·61
VI.	Clifton, Pembroke Road	1·13	,,	Loch Ness, Drumnadrochit	2·51
,,	Moreton-in-Marsh, Longboro'	1·11	,,	Glencarron	9·33
,,	Ross, The Graig	·56	,,	Fearn, Lower Pitkerrie	1·04
,,	Shifnal, Hatton Grange	·99	XIX.	Invershin	1·95
,,	Wem Rectory	·50	,,	Altnaharra	3·48
,,	Cheadle, The Heath House	·74	,,	Bettyhill	2·64
,,	Coventry, Kingswood	1·54	,,	Watten	1·37
VII.	Market Overton	·65	XX.	Cork	3·58
,,	Market Rasen	·51	,,	Darrynane Abbey	4·31
,,	Bawtry, Hesley Hall	·32	,,	Glenam [Clonmel]	3·13
VIII.	Neston, Hinderton	·55	,,	Ballingarry, Gurteen	2·00
,,	Southport, Hesketh Park	·62	,,	Miltown Malbay	2·59
,,	Chatburn, Middlewood	1·43	XXI.	Gorey, Courtown House	1·37
,,	Cartmel, Flookburgh	1·52	,,	Moynalty, Westland	2·74
IX.	Langsett Moor, Up. Midhope	1·27	,,	Athlone, Twyford	1·91
,,	Scalby, Silverdale	·66	,,	Mullingar, Belvedere	2·86
,,	Ingleby Greenhow	·49	XXII.	Woodlawn	3·14
,,	Middleton, Mickleton	1·08	,,	Westport, Murrisk Abbey	3·53
X.	Beltingham	1·12	,,	Crossmolina, Enniscoe	5·53
,,	Font Reservoir, Fallowlees	1·38	,,	Collooney, Markree Obsy	3·46
,,	Ilderton, Lilburn Cottage	·52	XXIII.	Enniskillen, Portora	2·89
,,	Keswick, The Bank	3·34	,,	Warrenpoint	1·63
XI.	Llanfrechfa Grange	1·28	,,	Banbridge, Milltown	1·61
,,	Treherbert, Tyn-y-waun	3·33	,,	Belfast, Springfield	2·78
,,	Carmarthen, Friary	1·77	,,	Bushmills, Dundarave	2·77
,,	Castle Malgwyn	1·53	,,	Stewartstown	2·47
,,	Plynlimon	4·80	,,	Killybegs	3·15
,,	Tallyllyn	3·00	,,	Horn Head	3·90

METEOROLOGICAL NOTES ON DECEMBER, 1905.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunder-storm; R for Rain; H for Hail; S for Snow.

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—Mild with fairly uniform temp. and great deficiency of sunshine and R. Although the prevailing type of weather was anticyclonic, there was practically no frost and the mean temp. was 41°·0, or 1°·8 above the average. Dense fogs occurred in London on 10th and 11th, but on no other day. Duration of sunshine 12·4* hours and of R 28·4 hours. Absolute drought for 18 days from 9th to 26th.

TENTERDEN.—Dull with some fog and very deficient R, though the first week was showery. Brilliant sunshine on 6th, from 9th to 11th, and on Christmas Day, but on only 6 other days, the total duration amounting to 39·7† hours.

CROWBOROUGH.—Dark and gloomy with much mist and deficient R. With the exception of some slight frosts from 9th to 12th and severe frost on 31st, the weather was mild. Absence of strong winds. Mean temp. 39°·3.

OSBORNE.—R about two inches below the average of 48 years and the smallest in December since 1890.

HARTLEY WINTNEY.—The driest December ever recorded. Fog and slight showers prevailed during the first week, but the remainder was beautifully fine, dry and warm. Ozone on 13 days with a mean of 3·1.

BURY ST. EDMUNDS.—Dull and foggy with no sharp frosts. Water was very short in rivers, ponds and deep wells.

BLAKENEY.—R 1·15 in. below the average of 12 years and the lowest in that period. From 9th to 27th, inclusive, only ·03 in. of R fell.

ALDERBURY.—Although there was very little R, there was great humidity of the atmosphere and roads were unusually and persistently muddy. Much fog and mist.

TORQUAY.—The driest December since 1883. Mean temp. 45°·1, or 1°·5 above the average. Duration of sunshine 49·9* hours, or 3·4 hours below the average. Mean amount of ozone 3·8; max. 6·5 on 19th with S.W. wind and on 27th with S.E. wind; min. 1·0 on 4th with N.E. wind.

WELLINGTON.—A great contrast to November, being exceptionally dry with few rough days and an equable temp. from 9th to the end, the max. being always between 40° and 50°. R about one-fourth of the average.

NORTH CADBURY.—The calmest month in 9 years and the driest December in 10 years, the fall being less than half that of the previous driest. Almost absolute calm prevailed for a complete week from 10th to 16th. The mean min. temp. was above that of November and only just below that of October.

CLIFTON.—R 2·25 in. below the average. From 5th to 8th was rainy, but the remainder dry and dull, with a good deal of fog till 13th. Very little frost.

STROUD.—Fine, mild and warm with bright sunshine. Primroses were in bloom and snowdrops in bud.

ROSS.—The least R in December since 1818 except in 1840, when only ·33 in. fell. Mean temp. 39°·8, or slightly above the average of 40 years.

WOOLSTASTON.—Dry on the whole and favourable for out-door work. Some fog, but not an excessive amount.

WORKSOP.—The driest December for 31 years, though in 1892 there was only ·01 in. more.

BOLTON.—Mild, cloudy and misty with no frost in the screen till 28th. A great number of calm days. Mean temp. 40°·6, or 1°·9 above the average. Duration of sunshine 11·4* hours, or 3·9 hours below the average.

SOUTHPORT.—In several respects a remarkable month. It was the driest December in 35 years, with exceptionally high mean bar., and abnormal equability of temp., due to absence of low minima. It was, however, notable for

* Campbell-Stokes. † Jordan.

the largest amount of sunshine recorded in December, having 22 hours more than the average. Mean temp. 2°·8 above the average.

UPPER MIDHOPE.—Mild, open and very dry till 27th, wet on 28th and 29th, wintry on 30th and 31st. The driest December since 1892. Windy on 22 days and stormy on 9. Fog on 7 days and 6 nights.

NEWCASTLE.—The smallest R in December since 1873, when ·39 in. fell.

LILBURN COTTAGE.—Extremely dry and mild, but cold at the end. The atmosphere was generally clear with a large amount of sunshine. No gales.

LLANFRECHFA GRANGE.—Fine and mild, with less than a third of the usual amount of R, which was much wanted for springs. Agricultural work was well forward and root crops were good.

CARMARTHEN.—Remarkably dry and fine. Grass was growing during the month and many meadows looked quite green and spring-like.

HAVERFORDWEST.—Wet until 7th, after which it was mostly fine and mild, strawberries and primroses being in bloom. Duration of sunshine 38·1* hours. Gales on 5 days.

DOUGLAS.—Fine and open with no frost or fog and many beautiful days. By far the driest December since records began in 1874. The mean bar. was abnormally high, reaching 30·88 in. on 12th. There were no violent gales but an excess of rough nights, and severe E. gales on 30th and 31st, which destroyed all garden flowers, of which there were an unusual number.

SCOTLAND.

LANGHOLM.—R 2·33 in. below the average of 28 years.

LILLIESLEAF.—Very mild and dry. Hunting was not prevented for a single day during the season so far. Ploughing was well forward and farmers quite contented.

INVERARAY.—Very wet till 24th, after which there were a few pleasant, fine and very mild days, the month ending with E. wind and slight frosts.

MULL, QUINISH.—Mild, wet and unsettled till 23rd; thereafter cold and dry with strong S.E. wind.

COUPAR ANGUS.—Favourable weather to 11th with little R and a fair amount of sun, but during the last two weeks, although the temp. kept well above the normal, the incessant light R and cloudy weather kept the roads wretched. There were no storms or gales. Mean temp. 40°·4.

DRUMNADROCHIT.—R 1·74 in., and rainy days 2, below the average of 19 years. The latter half genial, with frost on the last few days. No S so far at this level.

WATTEN.—Fresh and open. The last three weeks were dry and mild.

CASTLETOWN.—The early part was mild and wet with fresh gales from 7th to 9th. Then mild and damp till the last few days when it became colder. Practically no S.

IRELAND.

CORK.—Dull, dark, foggy and mild. Frost occurred in the screen on one day only, and the mean temp. was 4°·4 above that of November. Half the total R fell on the last two days.

DARRYNANE ABBEY.—R only 80·1 per cent. of the average, the first two weeks being dry.

WATERFORD.—The driest December since 1883.

HURDLESTOWN.—The driest December on record here.

MILTOWN MALBAY.—Mild, with no frost and R far below the average. Heavy S.E. gale on 30th and 31st.

DUBLIN.—An open month with southerly winds and cloudy sky, closing with a cold S.E. gale, darkness and R. Mean temp. 47°·1.

BANBRIDGE.—R 1·20 in. below the average of 40 years.

BELFAST.—Dull and foggy with hardly any frost and R considerably under the average.

OMAGH.—The weather was remarkably mild with no S and no frost, constituting a record for December.

Climatological Table for the British Empire, July, 1905.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	85·3	26	49·8	7	78·5	57·7	57·5	73	134·6	44·4	·96	8	4·9
Malta	94·7	7	68·9	16	88·1	72·7	71·3	77	141·7	63·5	·63	2	1·9
Lagos	...	...	...	...	...	...	...	...	...	...	...	...	...
Cape Town	75·8	15	41·4	11	64·9	52·2	50·8	76	...	...	2·46	10	4·8
Durban, Natal	83·9	11	47·3	9	75·4	53·7	...	...	133·9	...	·71	4	1·7
Johannesburg	66·5	2	30·5	16	60·6	41·2	34·0	61	121·0	12·0	·00	0	0·4
Mauritius	79·1	6	56·5	20	75·9	62·7	60·8	77	139·8	47·5	1·62	14	6·1
Calcutta	93·9	16	74·7	7	88·3	78·1	77·5	86	161·2	73·0	24·84	19	8·3
Bombay	88·2	9	75·4	23	85·4	78·8	77·0	84	133·7	73·8	15·30	28	8·9
Madras	104·9	3	75·6	29	100·3	80·2	71·7	64	148·3	72·6	2·31	15	3·9
Kodaikanal	69·4		49·7	7	64·6	52·7	50·2	76	146·6	41·7	2·68	14	6·2
Colombo, Ceylon	87·4	8*a*	76·5	19	86·4	78·6	74·2	80	145·5	74·2	1·25	13	5·4
Hongkong	91·3	18	73·8	7	87·8	78·1	75·4	80	147·5	...	9·02	16	6·3
Melbourne	62·9	21	35·0	4	54·8	43·0	41·3	77	117·8	27·6	3·28	19	6·9
Adelaide	66·0	8	36·3	31	58·2	45·0	45·6	78	120·0	31·2	3·32	22	6·2
Coolgardie	71·2	27	32·9	12	63·2	40·0	38·4	61	139·2	24·2	·29	5	3·9
Sydney	70·0	...	38·6	...	59·1	44·4	39·4	72	98·2	29·3	·39	13	5·6
Wellington	62·9	23	33·2	3	...	...	41·1	74	100·0	29·5	2·19	14	5·9
Auckland	60·0	23*b*	40·0	3, 10	55·7	44·6	44·3	81	117·0	36·0	3·88	18	5·7
Jamaica, Negril Point	91·6	15*c*	70·1	2	88·2	73·0	72·7	75	...	...	3·53	12	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	85·6	5, 14	69·0	26	83·7	74·9	72·3	80	144·2	...	10·28	28	4·8
Toronto	92·1	18	51·3	21	78·8	60·6	61·7	76	...	45·4	4·72	14	5·5
Fredericton	87·7	8*d*	46·0	23	79·2	55·1	55·7	59	...	...	1·76	6	5·2
Winnipeg	86·8	10	46·0	8	76·6	54·0	...	...	...	...	4·35	8	4·5
Victoria, B.C.	84·2	8	50·5	2	69·0	53·5	...	...	...	...	·10	1	2·4
Dawson	83·6	20	35·0	7	70·8	47·8	...	...	...	...	1·93	7	4·6

a and 28, 30. *b* and 24. *c* and 19. *d* and 9, 13.

MALTA.—Mean temp. of air 79°·1, or 1°·4 above average. Mean temp. of sea 81°·8. Mean hourly velocity of wind 6·4, or 1·0 below average.

Mauritius.—Mean temp. of air 1°·1, dew point 1°·4 above, and rainfall ·57 in. below, averages. Mean hourly velocity of wind 9·6 miles, or 2·4 below average.

MADRAS.—Bright sunshine 172·8 hours.

KODAIKANAL.—Bright sunshine 170 hours. Mean daily velocity of wind 389 miles.

COLOMBO.—Mean temp. 82°·1 or 1°·5 above, of dew point 0°·9 above, and R 3·26 in. below averages. Mean hourly velocity of wind 8·4 miles; prevailing direction S.W.

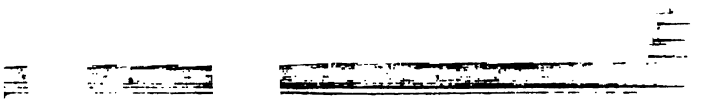
HONGKONG.—Mean temp. of air 82°·3. Mean direction of wind S.S.E., and mean hourly velocity 7·8 miles. Bright sunshine 243·5 hours, or 43 hours above average, and R 4·30 in. below 20 years' average.

Adelaide.—R ·78 in. above average.

Sydney.—R 4·26 in. below average.

Wellington.—R 3·64 in. below average.

Auckland.—Mean temp. of air 2° below, and R 1·00 in. below, averages.



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